Municipal and County Engineering

DESIGN, CONSTRUCTION, OPERATION AND MAINTENANCE OF ALL PUBLIC WORKS

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Contractors—are you ready?

THE roadbuilding boom has started. Illinois and Pennsylvania have voted bond issues of $60,000,000 and $50,000,000, respectively, for state-wide highway systems. Many other states and counties are considering ways and means of voting similar issues—some, even larger.

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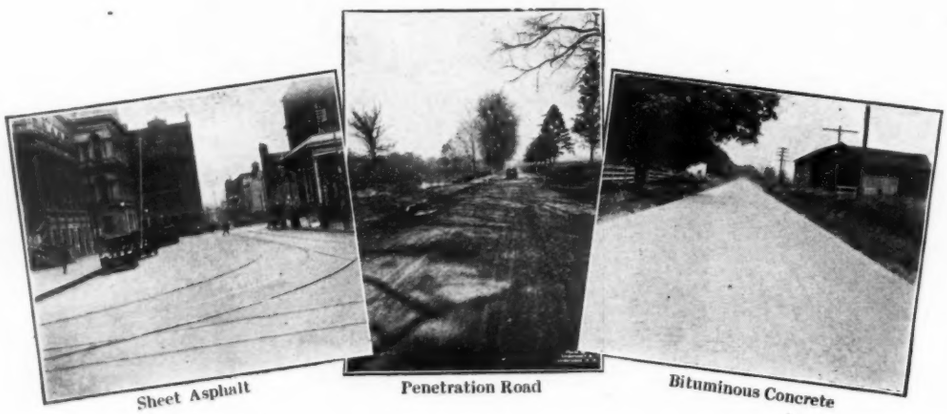

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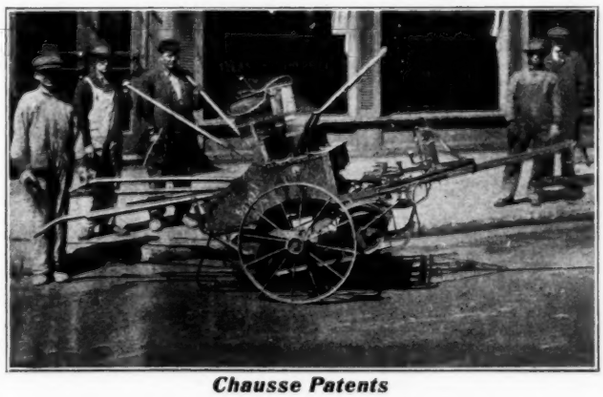

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Indianapolis, Indiana

PLANTS: Indianapolis Minneapolis Mobile Seattle Norfolk

MOTOR TRUCKS

Relation Between Economic Use of Motor Trucks and Proper Construction of Highways

DUPLEX FOUR WHEEL DRIVE TRUCK, OWNED BY INGHAM COUNTY, MICHIGAN, HAULING EVER CLEAN GRAVEL SCREEN FROM PLANT OF BEACH MANUFACTURING COMPANY AT CHARLOTTE.

Printed as insert to Municipal and County Engineering, February, 1919.

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The powerful winch on MACK Trucks makes loading quick, easy and safe. Heavy, unwieldy machines and ponderous loads of all kinds are handled with a minimum of effort and expense. And the winch takes up only 22 square inches of floor space.

Super-strength of construction and the powerful, heavy duty engine combine to make MACK Trucks, the deliberate choice of engineers where Truck endurance, strength, power and speed, with economy in operation are demanded.

"The most satisfactory truck we have ever used. Nothing can equal MACK Trucks" is the opinion of Mr. McCoy of the Borough Asphalt Company, who employs a dozen 5½ ton MACK A. C. Trucks.

Performance—not price or promise—*counts.*

MACK capacities 1 to 7½ tons, with trailers to 15 tons.

Facts and figures gladly furnished.

INTERNATIONAL MOTOR COMPANY
NEW YORK

"Performance Counts"

The Dependability of a Wilson Truck

Was demonstrated on road grading work in West Virginia where a Wilson 2-ton Dump Truck operated in conjunction with a steam shovel. The picture herewith shows the shovel loading the truck.

IT will be noted from the illustration that horse-drawn dump wagons were used on the same job.

The object of the work was to reduce the grade of a 14 per cent hill, and the earth removed was used to raise the grade at the foot of the hill. The truck ran down from the point where the shovel was located—a distance of about 200 yards—and dumped the earth and then turned off the embankment so created into the bed of a dry creek, and traveled up this bed to the top of the hill, where a turn was made in order to get by the shovel.

The truck easily outdistanced the horse-drawn wagons which were used on the work, both in cutting down the hill, discharging the load and returning. The motor truck made approximately three round trips in the time taken by horse-drawn vehicles in making one round trip. At the point where the fill occurred, owing to the steep angles of the sides and the soft material, the horse-drawn vehicles were overturned at least on every other trip. Owing to the superior control of the motor-driven vehicle and its ability to use great power instantaneously when necessary to overcome a capsizing inclination, it did not overturn a single time. Every load carried was one of 3½ tons, but in spite of this great overload the truck operated satisfactorily.

Wilson Trucks have a reputation for being built right and for staying right. They are simple in construction and have a minimum number of parts.

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J. C. WILSON COMPANY, Detroit, Mich.

Motor Truck Operation and Accounting XLII

In considering the question of the economic use of motor trucks, it should first be made clear that there are two principal and at the same time, radically different ways of looking at such a problem. And when the whole thing is sifted down to the fine point, we will all agree that in the end, the economic use of motor trucks in any line of business, starting with the farmer and ending with the manufacturer who is delivering his product from the factory to the railroad, or, as is so frequently being done in these days of serious freight congestion, direct to the dealer and even to the user, depends principally on the condition of the roads over which the motor truck must travel to make such deliveries.

All manufacturers of motor trucks build their models of various capacities to carry loads of the rated capacity of the truck. If the roads over which the truck must be driven are so rough that capacity loads cannot be carried safely, or if they are, after rains and during the spring season, so deep in mud that the load must necessarily be cut down, the truck is losing materially in efficiency and therefore in earning power.

Unit Cost Not Cost Per Day

One way of looking at the question of the economic use of motor trucks is, as unfortunately too many users of trucks view the problem, directly from the standpoint of dollars and cents. It is surprising how many purchasers of motor trucks are considering the purchase of such equipment with the main thought in mind of actually making a profit on their hauling. Usually such purchasers have long been users of the horse and wagon, which in almost every case is a slow and costly method. They will say that the operation of a double team, hauling, we will say, 1½ tons, will cost them a certain amount per day. They will then expect the operation of a motor truck of like capacity to cost them not over the same amount, and in many cases will, owing to the generally accepted statement known from one end of the country to the other, expect the motor truck to cost even less than this amount. But they lose sight of the fact that in a day of a given number of hours, the motor trucks, working under any ordinary and fair road or street conditions, will make from two to four times as many trips as will the teams, and consequently deliver from two to four times as much product, without carrying any overload on the truck, as will the teams. Generally it will cost slightly more to deliver this greatly increased tonnage, but it is far more profitable in the end from the ledger standpoint. The individual or concern, however, which has only enough business and consequent deliveries, to keep a team busy for a day of eight or ten hours, should not consider the purchase of a motor truck unless it is possible to secure sufficient outside hauling to keep the truck busy for the remainder of the ordinary working day.

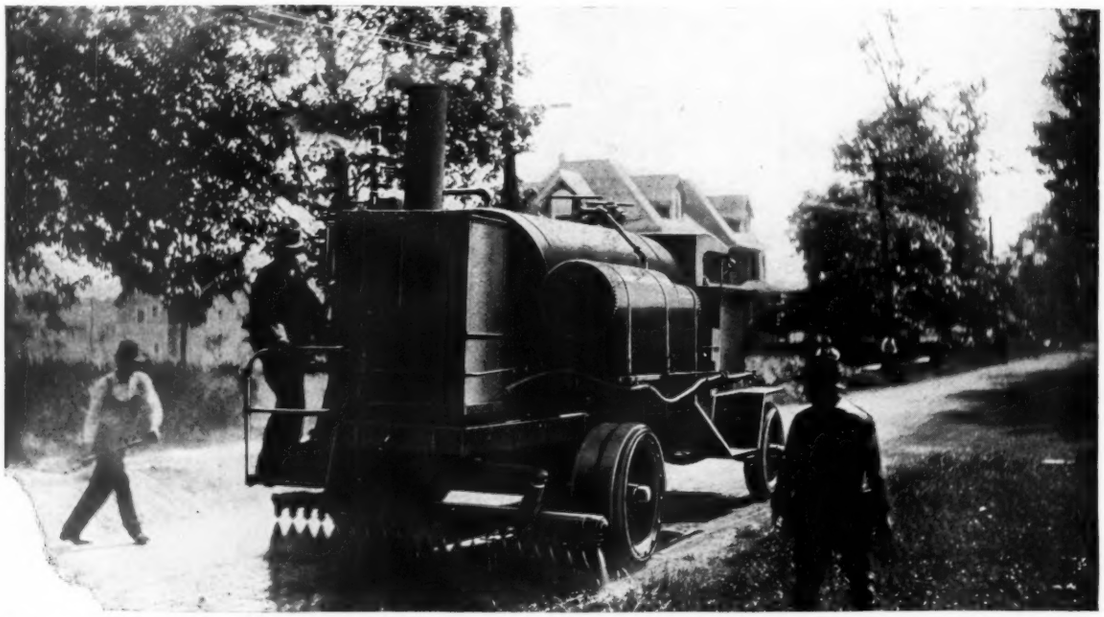
If the truck, working say twice as fast as the team, is able to complete the day's hauling by noon, and is then forced to stand at the curb or in a garage for the remainder of the day, it will not, under ordinary circumstances, show up favorably as compared with the team, and prove, as the purchaser may have anticipated, a profitable investment.

Use of Trucks by Farmers

I know of many cases where one farmer will invest in a high class motor truck, although he will not have enough products from his own farm to keep the truck busy all the time. Arrangements are made at a comparatively low rate, however, with other farmers in the vicinity, generally on the way to the market or shipping point, whereby stops are made for additional material that is to be taken to the same market. Full loads are therefore carried, and at the lowest possible cost. The same arrangement is made in returning, as supplies, equipment, etc., that are required by these same farmers, are hauled back, providing pay loads both ways.

Speed of Delivery

The other side of looking at the question of the economic use of motor trucks is from the standpoint of speed of delivery,



MACK 3½-TON CHASSIS AS OPERATED BY THE STANDARD OIL COMPANY IN THE APPLICATION OF HOT BITUMINOUS BINDER, VIEW SHOWS DISTRIBUTING NOZZLES AND OPERATOR'S PLATFORM.

The Seal of Dependable Performance

ACME THE TRUCK OF PROVED UNITS

Trade Mark Registered U. S. Patent Office

Where Mechanical Perfection Counts

In the manufacturer of the Acme Truck only such units of construction are used which have been endorsed by the engineering experts of the automobile world.

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Built in One to Five Ton Models—bodies built in our own factories.

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The Truck of Proved Units

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Gentlemen—We are using a two-ton Acme truck for general purposes, such as cartage of lumber, concrete burial vaults and concrete building blocks. Our concrete burial vaults weigh 2,500 pounds each, and we have carried two on the truck at the same time without any trouble, including three men and equipment that weighs 350 pounds, while the men weigh 500 pounds, making a total of 5,800 pounds.

The truck has given us the best of satisfaction, and we can recommend the Acme to anyone wishing a truck for general purposes.

(Signed) E. H. Hubman.

RIKER 5-TON DUMP TRUCK AS OPERATED BY THE HIGHWAY DEPARTMENT OF THE TOWN OF MILTON, MASS.

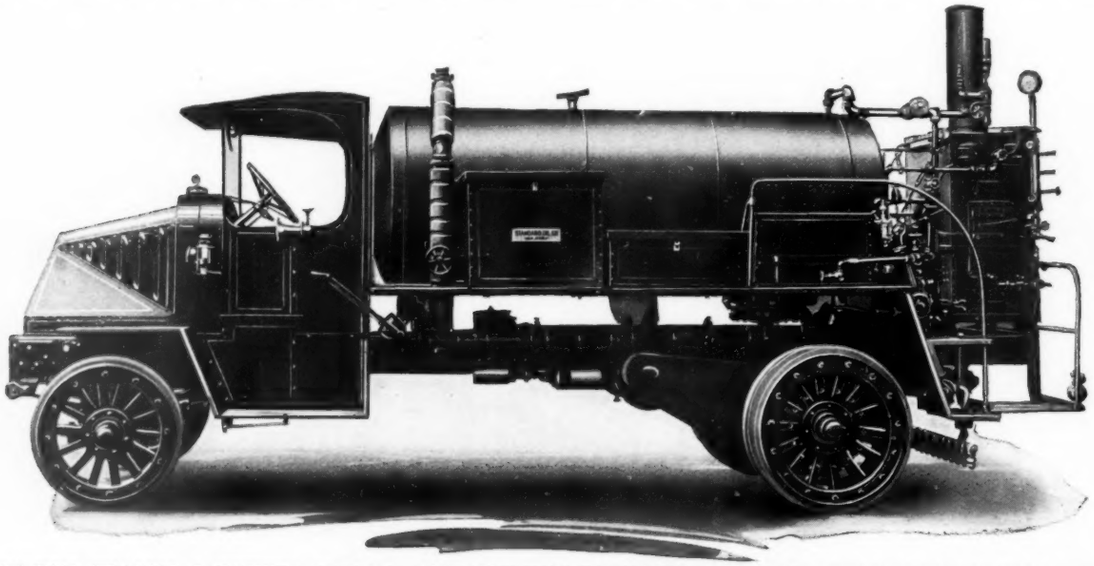
thereby increasing production, securing higher prices for prompter deliveries or for fresher products, as in the case of farm and garden products. An example of the latter was noted in Florida last winter at a large tomato packing plant. The growers who shipped by rail to the packing plant received 10 cents per crate less for their product than did the fifty or more growers who either shipped their tomatoes via highways in their own or in community owned motor trucks. The reason for this was that the tomatoes shipped by rail were two days longer in reaching the refrigerator cars than were those shipped via motor truck. The roads in that section of the country are all level, hard surfaced and smooth as a floor. Tomatoes for shipment North are picked green and ripen en route, so that those shipped by motor truck could be given two days longer on the vines than could those which had to be shipped by rail. Consequently they were a better product and could command a higher price.

Practically the same condition prevails today in the vicinity of every large city and within a radius of from 50 to 100 miles of every important railroad terminal. Congestion of freight, which has played havoc with business in so many lines during the past year, has caused losses aggregating many millions of dollars to shippers in such localities. The result has been that even the railroads, which formerly opposed the establishing of any motor freight lines which would become competitive, have not only sanctioned the establishing of motor truck auxiliary short haul lines, but have assisted such lines in securing sufficient freight to keep the trucks busy.

In such cases as have just been cited, the hauling charges for freight by motor truck may be a few cents per hundred pounds higher than the rates would be by rail shipment, but even if such is the case, the increase is seldom criticized or questioned in any manner. In these days it can truthfully be said that a consignment of freight arrives at its destination "only when it can be gotten there," and not when it is due. Shipments by motor truck are and have been run on regular schedule that has been found to vary but a few minutes, and the consignee expecting his shipment can, in almost every instance, feel certain that it will be there without the delay that he knows is certain to occur if the same shipment is made by local freight.

Road Conditions

Reference was made at the beginning of this article to road conditions as relate to the operation of motor trucks. This



MACK 5½-TON CHASSIS CARRYING SPECIAL DISTRIBUTING EQUIPMENT FOR THE APPLICATION OF HOT BITUMINOUS BINDER TO ROADS, OPERATED BY THE STANDARD OIL COMPANY.

Schacht WORM DRIVE Motor Trucks

Eleven Years of Hard Usage Proves Schacht Stamina

IN THE contracting and building material fields, Schacht Trucks have been especially appreciated since they first went to work 11 years ago—appreciated for their clean, simple design and their brute strength and stamina.

They are not assembled trucks—every part is made in the same plant. Eighteen years of automobile engineering experience is built into them. For seven years they have been definitely out of the experimental stage.

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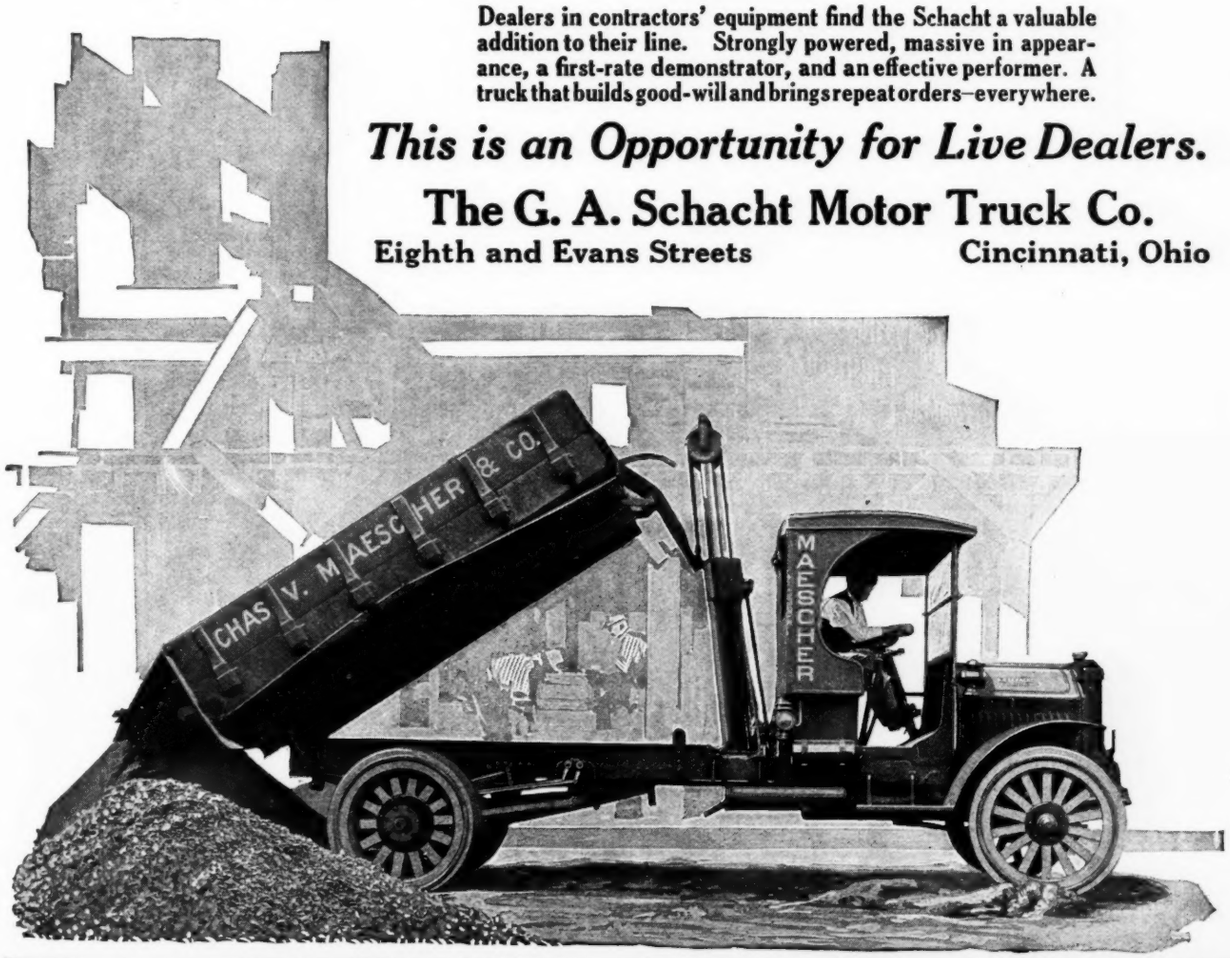
Dealers in contractors' equipment find the Schacht a valuable addition to their line. Strongly powered, massive in appearance, a first-rate demonstrator, and an effective performer. A truck that builds good-will and brings repeat orders—everywhere.

This is an Opportunity for Live Dealers.

The G. A. Schacht Motor Truck Co.

Eighth and Evans Streets **Cincinnati, Ohio**



is something that we are all going to have to pay a great deal more attention to from now on. The motor truck has become a business necessity. Is not this conclusively demonstrated and proved by the fact that although there were 78,000 motor trucks produced in the United States in 1916 for strictly domestic use, the production in 1917 jumped to 153,000, an increase of almost 100 per cent? And there was undoubtedly another 100 per cent increase in production for domestic use last year, as the truck manufacturers of this country had made provision and planned production for 310,000 trucks in 1918 which included, of course, Government trucks. This is silent but conclusive evidence that the use of the motor truck has proven economical to hundreds of thousands of users. Even more so, however, is the fact that approximately one-third of the production last year and in 1917 was demanded by individuals and concerns that were already users of motor trucks, and who had found that additional trucks were absolutely necessary.

Road Construction

It will be seen that this all has a direct bearing on the problem of road construction. Truck production has increased by leaps and bounds. That can only mean that the use of the truck is going to increase at the same rate, as no manufacturers can or will build their trucks in greater numbers than they are able to dispose of them. Ninety per cent of the trucks sold use the rural highways to a greater or less extent. Many of these trucks are on the highways practically all the time. Only about ten per cent of the trucks in use today never leave the city streets. This means, and it has already been proven in the principal eastern states, that the roads that we have built during the past five years are not strong enough to stand up under this traffic. We must look this situation squarely in the face and take immediate steps to overcome the difficulties. The higher types of road must be laid on routes where the traffic demands. This will unquestionably mean that some routes will have to be neglected so that other and more important ones may be given the additional funds that will necessarily be required for the construction of a roadway surface of a higher type. Our roads throughout New York State, Pennsylvania, Massachusetts, New Jersey, Ohio, Illinois, and other states where the motor truck traffic is very heavy, are going to pieces so rapidly that it is alarming. And as the roads go to pieces, so do the motor trucks. The latter, driven continually over rough and badly rutted roads, soon shake themselves to pieces, maintenance and repair charges become excessive, and their use becomes not only non-economic but prohibitive. When this condition prevails, the people are going to have to pay for it. Prices will continue to advance on farm products. It stands to reason that if 500 lbs. of garden truck can be hauled over a worn out and broken down road, at least double this amount can be hauled in the same vehicle over a road that is in good condition, and that it can be hauled in less time and at a lower cost. The farmer is adding the cost of transportation to the price he would ask for his product at his farm. The day has gone by when he overlooks this item. Therefore the people will pay for the bad roads, and also for the damage that is done through the existence of bad roads to the vehicle that carried the product over the bad roads.

Heavier Road Foundations

This heavy increase in motor truck traffic will make necessary the use of heavier foundations, in the case of roads of the pavement type, and of heavier cross-section in the case of roads of other types. It is granted that it will cost more to build such roads from now on, but it will pay huge interest on the investment within a very few years. Is it not better to pay $15,000 today for a mile of road that will be there, and with proper maintenance and repair, be in good condition, at the end of five years, than to build two miles of an inferior type of road at $7,500 per mile that will cost $1,000 per mile per year to maintain and repair, and then have to be resurfaced at the end of four or five years at the very latest at still an additional expense of $4,000 or $5,000 per mile? The expenditure of such sums, let it be distinctly understood, is only made in reference to main, or trunk line highways. They are the roads that will be widely used by the motor truck, and they will be the roads on which the wear and tear will be the greatest. The lower types of road are the ones that should still be used for feeders to the main line roads. Care in planning a road should be given to the possibilities of traffic in the future, and, if it is today a road of minor importance, to give full consideration to the possibilities of that road in the next five or ten years, and what traffic and the class of traffic it may have to carry. Much money that would otherwise be wasted can very often be saved by such foresight.

Width of Roads

Another thing that should be given more consideration by the highway engineer is the width of the main roads. A few years ago, 14 ft. was considered ample width. Then 16 ft. was found better. Now in our most progressive states, our highway departments are recommending and constructing main roads not less than 18 ft. in width between large cities, and more frequently 20 ft. roads. Loads on wagons and motor trucks are wider today than a few years ago. This is particularly true in the case of the motor truck. Excessive widths, however, should not be permitted in the case of either the motor truck or any other type of vehicle. They are always dangerous to other passing vehicles, and they also usually mean the overloading of the motor truck. No reputable manufacturer of motor trucks desires the construction of a body than will tend to increase the temptation to overload, thereby decreasing the efficiency and the economy of the truck by running up repair bills that will be certain to be required if such abuse is given the truck.

PACKARD TRUCK TAKING LOAD FROM LEE LOADER. ABOUT 45 SECONDS REQUIRED TO DUMP AND RETURN THE LOADER.

DUPLEX
4 WHEEL DRIVE

12TH YEAR

"The Duplex is a Life-Saver for the Other Trucks on That Long Climb"

Power in reserve—***in excess of all requirements***—dominates the Duplex—distinguishes the Duplex from any other type of motor truck.

Power to defy the hard ***pull—to exert the supreme effort at the top of the hill***—results from application of the Duplex 4-wheel drive principle.

Wastage of power is practically eliminated because all *four* Duplex wheels are ***workers.***

Because the Duplex wheels grip the road surface at *four* points, the maximum of energy generated by its motor is actually utilized as a ***pulling and hauling force.***

Its mighty power accounts for its dependability — dependability that keeps it ***out of storage*** during severe winter weather—dependability that insures ***unfaltering service.***

DUPLEX TRUCK COMPANY
2050 Washington Ave. Lansing, Mich.

With tire mileage greater—
And fuel consumption less—
Duplex cost per ton-mile is always lower.

DUPLEX FOUR WHEEL DRIVE TRUCK

We are going on,

THE Pierce-Arrow factory is going at full speed. It will keep going and Pierce-Arrow trucks will be available for the great reconstruction work that confronts us as they are needed.

The energy that met war problems unfailingly will meet the great problems of Peace.

Thousands of businesses face the emergency in the same spirit. Pierce-Arrow trucks will serve these—help them to conquer difficulties of transportation greater than those we

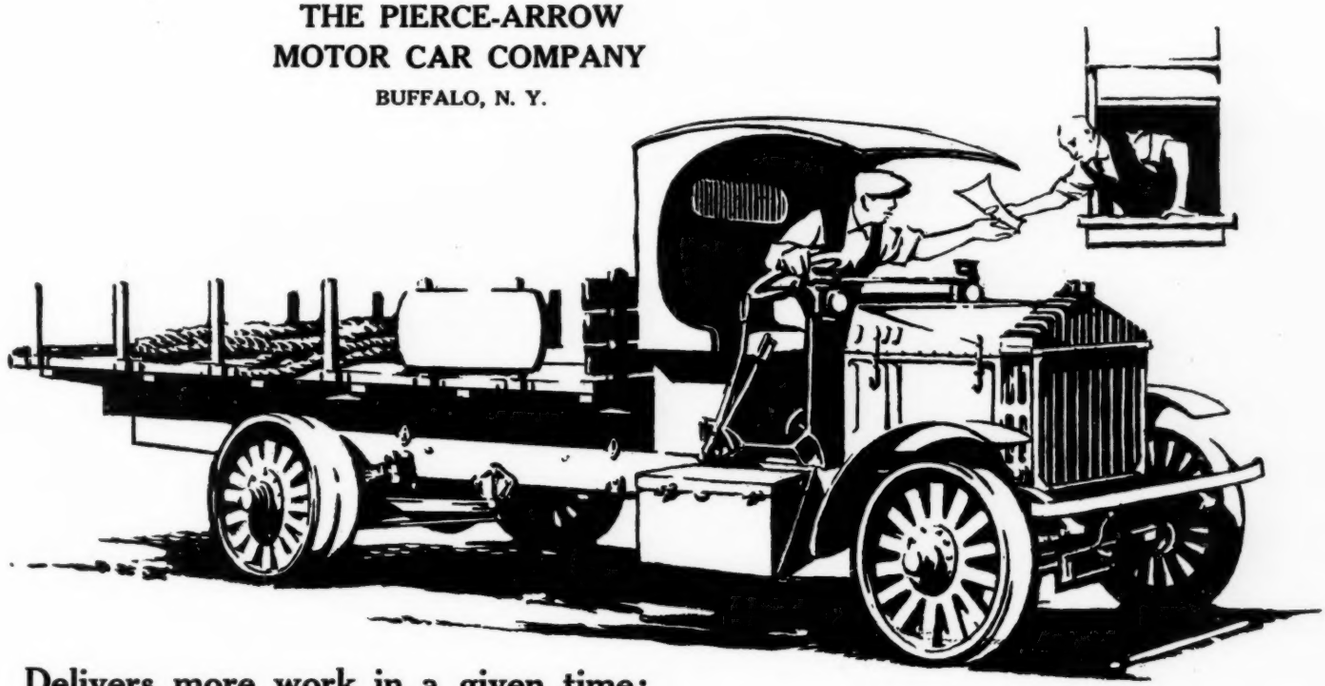
PIERCE-ARROW

Are you ready?

have conquered. We met successfully every condition of service in 148 lines of business. Call on us for help in expanding or redirecting transportation facilities.

The greatest opportunity America ever had is before us. Will you take advantage of it?

THE PIERCE-ARROW MOTOR CAR COMPANY
BUFFALO, N. Y.

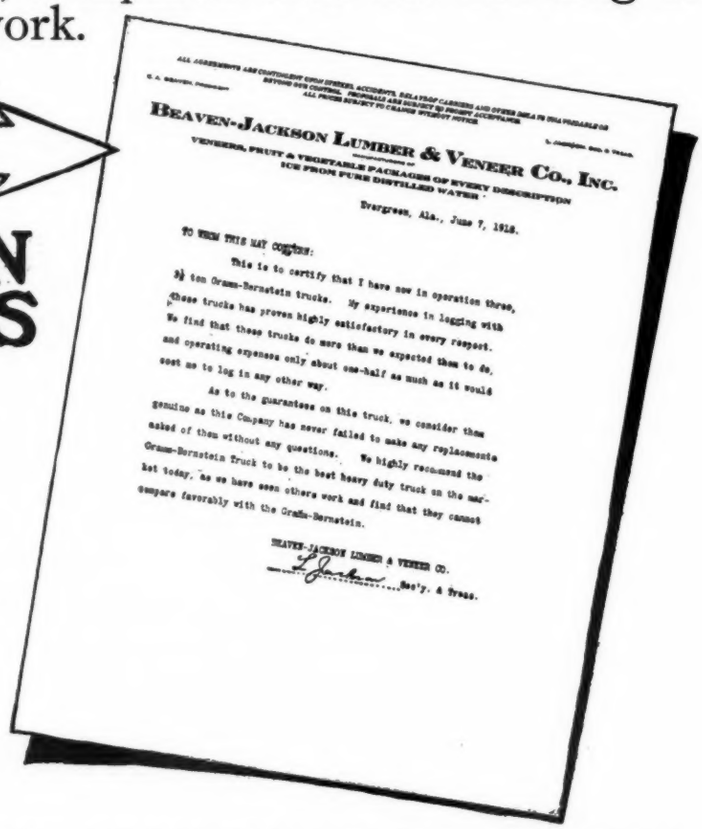


Delivers more work in a given time;
Loses less time on the job and off the job;
Costs less to operate and less to maintain;
Lasts longer, depreciates less and commands a higher resale price at all times.

"The Best Heavy Duty Truck on the Market"

That's the verdict of the Beaven-Jackson Lumber & Veneer Company based on their experience with three 3½ Ton Gramm-Bernstein trucks, compared with the showing of other trucks on the same work.

NOTE THEIR SATISFACTION



BEAVEN-JACKSON LUMBER & VENEER CO., INC.

VENEERS, FRUIT & VEGETABLE PACKAGES OF EVERY DESCRIPTION
ICE FROM PURE DISTILLED WATER

Evergreen, Ala., June 7, 1918.

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This is to certify that I have now in operation three, 3½ ton Gramm-Bernstein trucks. My experience in logging with these trucks has proven highly satisfactory in every respect. We find that these trucks do more than we expected them to do, and operating expenses only about one-half as much as it would cost me to log in any other way.

As to the guarantees on this truck, we consider them genuine as this Company has never failed to make any replacements asked of them without any questions. We highly recommend the Gramm-Bernstein truck to be the best heavy duty truck on the market today, as we have seen others work and find that they cannot compare favorably with the Gramm-Bernstein.

BEAVEN-JACKSON LUMBER & VENEER CO.
L. Jackson Sec'y. & Treas.

GRAMM-BERNSTEIN MOTOR TRUCKS

are appreciated most where working conditions are hardest. For it is in such service that the built-in quality and performance of these trucks most quickly and strikingly show. But in all lines, these characteristics mean longer life and lower cost.

THE GRAMM-BERNSTEIN MOTOR TRUCK COMPANY, LIMA, OHIO

Burch Stone Spreader a Money Saver

SAYS SURVEYOR OF RICHLAND COUNTY, OHIO.

Writing in *Municipal and County Engineering* of September, 1918, Boyd Wierman, Richland County Surveyor, said:

BURCH STONE SPREADER IN OPERATION

"Richland County, Ohio, owns two Burch stone spreaders, and their use has resulted in a substantial saving of labor and money. The data here given are based on our daily haul of 240 tons of crushed stone on I. C. H. No. 202 Sec. B, Mansfield-Galion road.

"Before the spreader was used on this work we hauled with trucks, and this required five men on the dump at 35 cents per hour, making an expense for an 8-hour day of $14 for spreading. Since placing the spreader in operation we have one man on the dump at 35 cents per hour, making an expense for an 8-hour day of $2.80 for spreading. This means a saving of $11.20 per day on spreading, due to the use of the spreader."

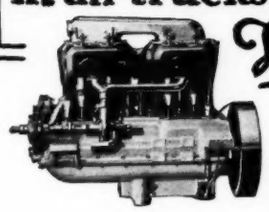
One of these Spreaders will pay for itself several times in a season.

The Spreader is built strong for hard and steady service. It is provided with chains to hook to a motor truck. Gate is adjustable to regulate depth of stone. Eliminates all trouble in spreading stone.

Write for information to

THE BURCH PLOW WORKS COMPANY, Crestline, Ohio.

Plenty *of* Reserve Power *for* the Hard Steady Plugging *of* Municipal Trucking in all trucks equipped with



Wisconsin CONSISTENT *Motors*

Write For specifications of different types and sizes.

WISCONSIN MOTOR MFG. CO.

Station A. Dept. 330. MILWAUKEE. WIS.

DO NOT FAIL

To read the letters from State Highway Engineers and City Engineers published in this issue.

These letters give details relating to many millions of dollars' worth of public improvements to be undertaken this year.

You never got so much timely, specific information from a single issue of any engineering magazine as is given in this issue of

Municipal and County Engineering

30% Saving in Wages and Time.

That is the record of **Heltzel "Lightning" Loaders** in the service of Heysteck & Co., of Kalamazoo, Mich.

Using four loaders they replaced eight men and effected a saving of 30% in time and labor in handling sand and crushed stone.

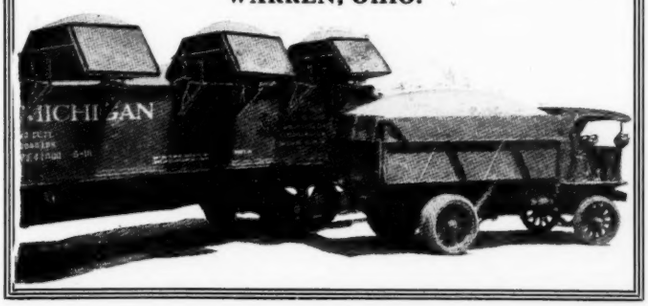
Each Skip loaded a 3-ton truck in two minutes. It was found that these "Lightning" Loaders made the shovelers work faster and more steadily.

The loaders are easily installed, give a clear discharge and stand up well under hard usage.

Get all the facts from

Heltzel Steel Form & Iron Co.

WARREN, OHIO.



KISSEL TRUCKS

It Sprinkles a Street Eighty Feet Wide Two Miles Above Sea Level

LEADVILLE, Colo., the highest incorporated city in the world, and the highest city operating a motor sprinkler, figured that on account of a motor having 30 per cent less power at an altitude of 10,000 feet, the sprinkling area of the above Kissel "Heavy Duty" Truck would be reduced 30 per cent—but the Kissel Truck proved otherwise, and is a vivid demonstration of the unlimited power of the Kissel-built engine, designed and constructed for motor truck purposes.

With the sprinkler tank partially filled, the Kissel Truck stopped in the middle of a short hill of 30 per cent grade, had its picture taken, started in low and went to the top without bucking. On Leadville's "6th Street Hill," 18 or 20 per cent grade, and nearly a mile long, the Kissel Truck made the hill on second gear with tank full.

In addition to street sprinkling, this Kissel Truck will be used in fighting fires in the outlying districts, where lumber mills and mining camps have no fire hydrants.

This is only another example of the stupendous power and brute strength that characterise the Kissel Motor Truck, and insures absolute dependability for those contractors, road builders, fire and water commissioners whose motor truck equipment must have 100 per cent strength and power.

Your nearest Kissel Dealer can supply you with further information and details on Kissel Motor Truck Equipment for every purpose. See him.

Kissel Motor Car Co.
HARTFORD, WIS., U.S.A.

Another FEDERAL

3½-Ton Federal—one of the fleet of seven Federals owned by the Cumberland County Road Commissioners, Hdq., Fayetteville, N. C.

Federal Demonstrates Worth on Construction Work

THE Cumberland County Road Commissioners, North Carolina, have found that motor truck haulage is a valuable item in securing the most efficient road construction work.

Careful tests were made in the hardest kinds of work, hauling sand, gravel, cement and like materials, and Federals stood up perfectly. Consequently today this city is operating seven Federals.

Federal stamina, rugged strength and economical operation, demonstrate the fitness of this truck for all kinds of haulage work.

"Return loads will cut your haulage costs"

Write us and we will send you the *"Traffic News,"* a publication for the truck owner and buyer.

Federal Motor Truck Company
35 Federal St. Detroit, Mich.

FEDERAL

One to Five Ton Capacities

Scores of Counties use HALL Trucks on Highway Construction and Maintenance Work

Some Progressive Counties have More than one HALL Truck on Highway Improvement Work.

Wyandotte County, Kansas, is one county operating more than one Hall on road work. Truck No. 1 in the Wyandotte County fleet is here illustrated.

Another Kansas County (Saline) has a fleet of Halls. Roane County, W. Va., is still another example where one good Hall deserves another.

These repeat orders are proof of the fitness of the Hall truck for road work.

The HALL 3½-ton truck has performed with great efficiency in the hard, rough work of building roads. This truck, equipped with a steel dump body and hydraulic hoist, has fully demonstrated its dependability as a road builder.

HALL Trucks are driven by the powerful Continental Motor and easily negotiate tough going, while assimilating all hard knocks. Every strain-bearing unit in this truck is made extra strong, providing an ample factor of safety against break-downs under unusual stress.

The HALL Road Truck ends the road builder's truck worries!

"HAUL IN A HALL"

Don't Experiment! Buy a Truck that has made good!

THE LEWIS-HALL IRON WORKS
Manufacturers of the HALL Truck
(Established 1873)
Ferry Avenue and Grand Trunk Ry. **DETROIT, MICH.**

EDITORIALS

"Public Works or Public Charity?"

A large portion of this issue is devoted to the publication of letters from city and state engineers outlining the construction work to be performed under their jurisdiction this year. Seeing what these cities and states propose doing, other cities and states should do proportionately as well according to their means.

Unless we resort to public works we shall of necessity have recourse to public charity. This is the view of students of economic and labor conditions.

Public Works or Public Charity? is the title of a pamphlet written by Harold G. Moulton, an economist of national reputation. Mr. Moulton is a member of the Department of Political Economy of the University of Chicago. The pamphlet was published and is being given wide distribution by the Union League Club of Chicago. It is also being distributed by the Emergency Public Works Commission of Pennsylvania, and perhaps by other agencies interested in holding stable the social order and in safeguarding business conditions generally.

The title of the pamphlet is self-defining and gives the key to the economist's conclusions. The first sentence of his formal conclusion reads:

"In view of the established facts of our industrial experience and in view of the grave possibility of depression during the transitional era—indeed, I think one may say in view of the facts of the immediate situation—with industry everywhere hesitant, and unemployment already rapidly increasing, is it not perfectly plain that a comprehensive program of public works should be instituted just as soon as possible?"

After stating that "we cannot permit either our returning soldiers or war workers to starve" he says: "We have the choice, therefore, of two methods of meeting the situation: (1) by providing employment on public works of enduring value or, (2) by supporting by public charity an army of unemployed in nonproductive idleness."

Let every municipal, county, state and federal official ask which alternative he will choose. Then let him start public works projects to the limit of his opportunities. If this is not done it will be well to organize soup kitchens and free bread dispensaries for we shall need them soon.

The leading editorial in the August, 1918, issue of Municipal and County Engineering was entitled: How Are the Plans Progressing? It concluded: "City officials who fail to plan now cannot hope to escape the most bitter criticism when the plans are wanted. They will be held guilty of totally inexcusable shortsightedness if not of gross stupidity."

Some cities, many in fact, did plan improvements for construction after the war. Others did nothing, apparently, but read the newspapers. Among the many good letters published in this issue a few are included as giving horrible examples of cities guilty of "totally inexcusable shortsightedness if not of gross stupidity." If ever it was easy to forecast anything it was that we should need improvement programs to stabilize industry at the end of the war. City officials who could plan and did not have demonstrated their unfitness to hold responsible public office and will undoubtedly be returned to private life as soon as the voters can get at them. By the same token, officials who do not now strain every nerve to plan improvements and place them under contract as soon as feasible will undoubtedly be turned out of office at the expiration of their present terms. That is another "cinch forecast."

In their introduction to the Moulton pamphlet the War Committee of the Union League Club of Chicago said:

"There is sound reason for believing that we shall be confronted with a grave unemployment problem during the next few months until war workers and returning soldiers can be reabsorbed into normal industry. The resumption of usual industry will be slow in many important branches.

"Only prompt action by government and municipal agencies through the inauguration of public works on a large scale can avail in meeting the impending critical situation, the consequent acute suffering and the unrest that will follow in the wake of wide-spread idleness. Interrupted work should be resumed at once; deferred work should be begun; new work contemplated for a later date should be promptly planned and be taken up now.

"The community should not postpone public work while awaiting lower costs. The cost of human discontent and resentment will overbalance a small percentage of monetary cost."

Are you ready for the question?

Public works or public charity; which?

Freight Rates on Construction Materials Should be Decreased Not Increased

At this time when the leading officials of the federal

government, and various departments of the executive branch of the government, are urging the beginning of public works construction at any cost as an emergency measure, it is difficult to discuss with patience any movement by the railway administration toward higher freight rates on construction materials. These rates are already too high; to increase them will kill many construction projects on which the immediate welfare of the nation depends.

A hearing was recently held in Chicago, before the local representatives of the United States Railway Administration, on proposed freight increases in one district on sand, gravel, crushed stone and slag, all essential materials of construction. The hearing was well attended by workers in the construction field from the district immediately concerned. The hearing was generally regarded as a try-out, it being the common understanding that if the increase in rates could be "put over" in the district in question and on the materials mentioned, similar increases would be made on other materials in this and other districts. With this prospect in view those who attended the hearing were thoroughly aroused to the imminent peril in the situation. Objections were heard and recorded and the decision in the premises has not yet been reached at the time of writing.

The objections raised were rather pointed in some cases. The suggested increase was frankly, and justly, characterized by some speakers as a thoroughly dangerous and uncalled for measure. The usually long-suffering and tolerant construction folk present were goaded, by this most untimely proposal, into a state of feeling closely approximating open rebellion and elemental wrath. The fact that the proceedings were parliamentary reflects great credit on the self-restraint and forbearance of the audience and, incidentally, demonstrates the fundamental soundness of our organized community life. In any country not so well balanced and even tempered as this, such an occasion would have produced a demonstration bordering on violence. Even so, had the identity of the author of this suggested freight increase been known he would have been made to feel the extreme displeasure with which his proposal was regarded, while remaining safe and secure in his person and estate.

The construction industry has a right to feel that it has been roughly handled in recent months. This is admitted by all. Having been bombarded, gassed, bayoneted and shot during the war, it is now to be throttled, on its way to the hospital, if the railway administration is not closely watched.

The construction industry must arouse itself and take its own part, especially as it has been encouraged to great effort by every agency concerned with the exception of the railway administration. There was gratifying evidence, at the hearing mentioned, that the construction men are not quite dead and may even have a good stiff fight left in them. When the amiable incompetent who presided at the meeting admitted his inability to answer a simple question and blandly and impersonally referred it to "any of the railway gentlemen in the audience" a roar went up from that audience that was an unmistakable sign of life. It was most encouraging. It caused one to feel that no longer will the construction industry remain "dumb as a lamb before her shearers."

There is said to be a sizeable deficit in railway earnings. Maybe so. And then again maybe not. The railways may be losing lots of money under government control but if so they are very complacent about it. The railway managers cannot be accused of undue haste in wanting to get the roads back. They seem to be afraid that they will get them back before they want them. The builder is a straightforward and simple man; he should remember that he cannot believe all he hears, that language is used to conceal thought as well as to express it.

Suppose the roads are losing money, which we very much doubt, but suppose they are. Why pick on a bankrupt industry as the one to make good the deficit? Of all industries the construction industry has suffered most and longest. It should be protected now, not only as an act of justice to a business almost killed by federal fiat, but especially because the entire country is depending on construction to safeguard prosperity this year.

If freight rates on construction materials are increased the volume of construction work will be substantially curtailed, employment for labor will not be provided as planned, and the country will surely suffer.

If the railways need more revenue they must get it some place else. Any further tax on the construction industry will tax it out of existence. Business men, generally, should be asked to co-operate with construction men in the effort to have lowered the freight rates on construction materials. The proposal to lower these rates is logical and just and will so appeal to the public. Pressure must be brought to bear on the railway administration to lower these rates. The co-operation of influential newspapers, chambers of commerce, and officials of the federal government can be easily enlisted in this cause. For example, the Department of Labor is doing everything it can to encourage construction. Perhaps the Secretary of Labor could be persuaded to reason with the Director General of Railroads. That would be a good starting point. No effort should be spared to have these freight rates lowered. A well organized and well sustained effort in that direction will surely succeed. Who will start it?

City and County Engineers Write of Construction Projects Planned to Provide Buffer Employment for Labor during Readjustment Period

The construction of public improvements of all sorts is urged by federal officials, economists and business men everywhere as a means of taking up the industrial slack while the country is being changed over from a war to a peace basis. That cities and counties are ready to do their share in providing work for the laboring classes is clearly shown by numerous letters to the editor of MUNICIPAL AND COUNTY ENGINEERING. The letters demonstrate the sympathy of city and county officials with this nation-wide movement to turn to construction as the only safeguard of prosperity in the present emergency. Many of the letters received by the editor are published herewith. They give much specific information on work planned for 1919:

Springfield, Ill.

Willis J. Spaulding, Commissioner of Public Property in the city of Springfield, writes:

"In reply to your inquiry regarding public work under the jurisdiction of the Department of Public Property, which may be undertaken as part of the general effort to take up slack in labor, our department has in view the completion of a 24-in. trunk line about 1½ miles in length which will cost something over $100,000; also the replacement and enlargement of our water distribution capacity in the downtown district which will cost perhaps $30,000 more. We also expect to make additions and extensions in our electric department for taking on commercial business, which will cost perhaps $75,000.

"We agree with you that the promotion of public work is important. Personally, I feel that while this movement will help some, it will be altogether inadequate. We are referred to the period immediately succeeding the Civil War as evidence that we need have no fears for the immediate future. At that time the country had vast areas of unoccupied lands to absorb all surplus labor. This is now practically all gone and unless some comprehensive reclamation scheme, such as Mr. Lane has outlined, is vigorously pushed, I look for a great deal of unemployment."

Milwaukee, Wis.

T. Chalkley Hatton, Chief Engineer, Milwaukee Sewerage Commission, writes:

"I beg to advise you that the Sewerage Commission of the city of Milwaukee has made plans and secured the necessary funds for carrying out about $1,014,000 worth of new work during the coming year and are now letting out contracts governing the construction of such work and will continue so to do as rapidly as the season is such that outside work can be properly carried on. In addition to this, there are seven contracts for outside construction, amounting to approximately $800,000, being carried on—that is, hanging over from last year.

"The Sewerage Commission has no desire whatever to hold up any work that can be properly carried on during this year and has, during the past six months, made every effort to have plans ready and money on hand to carry on as much work as possible after the war was over, as this method would be highly desirable for employing men released from strenuous employment during the war."

Fond du Lac, Wis.

J. S. McCullough, City Engineer of Fond du Lac, Wis., writes as follows:

"I beg to advise that our Commission has authorized us to prepare plans for a number of improvements to try to take care of the expected labor situation the coming season. The city authorities are making every effort to provide as much work as possible for the returning men, and the following work is practically assured: 22,500 sq. yds. paving; 17,600 lin. ft. combined curb and gutter; 4,700 sq. ft. of re-paving, aggregate cost approximately $60,000; about 1¾ miles of sewer work of various sizes, aggregate cost approximately $25,000; and renewal of bridges to the extent of $20,000.

In addition to this there is reasonable expectation of park improvements, including a recreation or memorial building, details of which have not yet been worked out, and the probable expenditure will be in the neighborhood of forty to fifty thousand dollars.

"The above projects will undoubtedly be carried through, and as the season progresses other sewer and pavement work is likely to be added."

Joliet, Ill.

C. D. O'Callahan, City Engineer, writes as follows:

"The city of Joliet, appreciating the necessity of furnishing employment to labor released from war activities, is engaged in the preparation of plans for public improvements, the estimated cost of which is $250,000. This work consists mainly of street pavements by special assessment. Improvements costing several times this amount are dire necessities of this municipality, but on account of the antiquated basic law of the state of Illinois, the cities are so restricted in issuing bonds or raising taxes to pay for improvements, that little can be done by Illinois cities except that which comes under the Special Assessment Act, and as this imposes the cost on only a portion of the citizens, at a time of high prices it should only be worked along justifiable lines.

"The state could in a large measure absorb the unemployed labor and materially assist in effecting a satisfied labor market by being prepared to let contracts on the $60,000,000 bond issue for good roads on 30 days' notice. I appreciate that a large amount of preliminary work is required before the State Highway Board can let contracts on this work, but believe that if such a policy as the Army and Navy used for intensive training of the young men for military service was applied to clearing up matters preparatory to starting actual work, that contracts could be let by May 1, 1919.

"There is a justification for speedy work along such lines and of being prepared to give employment to a large volume of unemployed men when, on account of high prices, the lack of employment will bring privations on millions of our people and will tend to cause industrial outbreaks."

Dayton, Ohio

F. O. Eichelberger, City Engineer, states that the following work is proposed for 1919:

Approximately 1.35 miles of brick pavement, 28,965 sq. yds., to cost $176,367; approximately .39 miles of wood block and granite durax paving, 13,400 sq. yds. wood block and 4,250 sq. yds. durax to cost $112,560; approximately 13.5 miles asphalt street repair to cost $33,000; approximately 6 miles brick repairing to cost $17,800; approximately 47.5 miles street oiling to cost $45,000.

Louisville, Ky.

John Chambers, Chief Engineer, Louisville Department of Engineering, writes:

"The complete construction program of the city of Louisville has not yet been prepared, but it is reasonably certain the following list will be included: Finzer avenue, Cherokee to Bardstown Road, 1 block; 15th street, Main to Walnut, 4 blocks; Breckenridge street, Logan to Barrett, 4 blocks; Hill

street, 3d to 4th, 1 block; Bank street, 25th to 26th, 1 block; 13th street, Market to Jefferson, 1 block. All of the above items with the exception of 15th street and 13th street, are to be in asphalt."

Akron, Ohio

E. A. Zeisloft, City Civil Engineer, Akron, writes as follows with reference to the program for proposed construction work to be undertaken in 1919:

"At the present time we have a paving program to the amount of $500,000; a program of sewerage to the amount of $195,000. This work is to be done this year, as the money is now in the fund to proceed.

"On March 4th the city will place a bond issue to the amount of $3,000,000 to the vote of the people, which if passed, will be used to commence the construction of a new sewerage system in this city, estimated to cost ultimately $10,000,000."

Buffalo, N. Y.

Geo. H. Norton, City Engineer of Buffalo, writes:

"While not under this department, the largest project under way by this city is in school building under an $8,000,000 program to include high school enlargement, grammar schools and twelve intermediate grade schools. This is under the school board.

"The largest construction items contemplated by this bureau are two storm-water drains. The cost of the two will be above one and one-half million dollars, and it is hoped to get some of the work under contract this year. Plans are under way but not completed. Three viaduct structures are to be partly rebuilt and work will soon be advertised.

"Dredging work will probably be continued on Buffalo river navigable channel and some improvements made in the lower river. This work will necessitate two new bridge structures, but nothing is yet definitely decided relative to them.

"Work will be continued on the Bird Island Pier dock and sewer extension under existing contracts. Three small pieces of dock aggregating about 250 ft. in length will be constructed, but plans are not yet completed.

"Paving work is uncertain in extent and much will depend upon prices and upon track construction by the Traction Company. Probably will be from 10 to 15 miles, including repaving.

"The Bureau of Streets expects to construct a new stable and also new storehouse. Funds and land for the former are provided.

"The Bureau of Water expects to extend a new 60-in. duplicate discharge from the Col. Francis G. Ward Pumping Station and to make other extensions.

It is the policy of the Council to put as much of this work as possible under contract at an early date, or as soon as contract conditions are sufficiently stabilized."

New Haven, Conn.

F. L. Ford, City Engineer of New Haven, writes:

"The city of New Haven, Connecticut, has bonds authorized and plans prepared for building the Tomlinson Bridge, estimated cost $500,000, and bridges on Orange street, and Willow street, costing about $40,000 each. Also for an enlargement of the city wharf, $250,000. Also for sewers, $300,000. Authority will soon be asked for $200,000 for street paving, much of this work was postponed on account of the war. Bids on some of it will be received as soon as prices on steel and cement are more favorable."

Mankato, Minn.

Harvey S. Dartt, City Engineer of Mankato, writes:

"In Mankato work on water and sewer extensions, storm sewers, roads and pavements will be pushed the coming year as rapidly as finances and good judgment will permit. No big projects are in view and there will be enough small ones left over to keep everybody going for the next two or three years. Mankato will do its full share to furnish employment for the manpower released by the close of the war."

McPherson County, Kansas

H. A. Rowland, Engineer of McPherson County, Kansas, writes as follows of the probable work to be done during the season of 1919:

"I will list the following:

"Lindsborg, Kan.—The city will soon advertise for bids upon 2 miles of brick paving, H. A. Rowland, engineer.

"McPherson, Kan.—The county commissioners have named a board of trustees to take charge of the erection of a county hospital to cost approximately $100,000.

"McPherson, Kan.—The Blaze Fork Drainage Board expects to call for bids soon for the construction of drainage ditches making an excavation of approximately 160,000 cu. yds. H. A. Rowland, engineer.

"McPherson, Kan.—The county will soon receive bids for about $15,000 worth of bridges and culverts."

Leadville, Colo.

Fred J. McNair, City Engineer of Leadville, writes:

"I beg to say that it is the intention of the city of Leadville, Colo., to improve the main automobile highway from one city limit to the other this year. This will include grading and surfacing, and the reconstruction of the concrete crossings on Harrison avenue."

Minneapolis, Minn.

Frederick W. Cappelen, City Engineer of Minneapolis, writes as follows regarding work for this year:

"I beg to state that money has been provided for the following items:

Paving and curb and gutter	$489,000
Oiling	217,000
Grading streets	173,000
Maintenance of dirt streets	288,000
Sewers	225,000
Water department	350,000
Bridges	25,000
Sidewalks	150,000

"Work proposed, depending on the sale of bonds, for which we have authority:

Paving and curb and gutter	$231,000
Sewers	150,000
Grading	300,000
River terminal	170,000

"Work contemplated for the next two years, for which we are requesting the present legislature authority to issue bonds for, for the city's portion of cost of work, in addition to such sums that may be set aside by the Board of Tax Levy:

Paving and curb and gutter	$400,000
Sewers	400,000
Bridges	600,000

"We have to get this authority from the Legislature now in session, because the Legislature will not meet again until 1921.

"In addition to the above work, the city council this afternoon (January 20) authorized me to start four trunk sewers, and four crews for laying water mains, and to do some river work and some grading; by which I can employ about 525 men of which about 400 will be soldiers, whose credentials will be honorable discharge papers, and citizens of Minneapolis, first; and if we cannot get enough men of this character, then discharged soldiers from elsewhere who may now wish to work in Minneapolis; and if we cannot get enough soldiers of this kind, then of course we will employ our own laborers.

"You will of course appreciate what it means to order this kind of work in this latitude at this time of year, but it is to show the city's willingness to do the utmost for homecoming soldiers at this time."

Kansas City, Mo.

Robert W. Waddell, City Engineer, gives the program of Kansas City up to January 21st, for the coming year:

"The following work is assured:

Twenty-third street viaduct	$ 800,000
Union Station approaches	130,000
Turkey Creek sewer	1,100,000
Granite paving west bottoms & Bluff St.	254,000
Thirty-first St., Pennsylvania to Main	14,000
General paving	750,000
District & Joint District sewers	400,000
Street repairs	200,000
Misc. work grading, curbing, etc.	100,000
	$3,748,000

"The following work is probable:

Sixth St. paving, brick	$ 60,000
Twelfth St. paving, brick	100,000
Summit St. paving, concrete	48,000
Beardsley St. paving, brick	75,000
Grand Ave. paving, wood blks. or brick.	215,000
Independence Ave. paving, brick	106,000
McGee St. trafficway paving, brick	120,000
Fifteenth St. paving, asphalt or brick	225,000
Eighteenth St. paving, asphalt or brick.	45,000
Raytown Road paving bitulithic or conc.	75,000
Blue River sewer	2,500,000
East Bottoms dike	900,000
	$4,469,000

Cleveland, Ohio

Robert Hoffman, Commissioner of Public Service and Chief Engineer, writes:

"It is difficult at present to furnish any very reliable statement of the amount of public work which may be placed under contract by this department the coming season. We have begun to take bids on both sewer and paving construction. We expect to place contracts during the season covering $1,500,000 worth of work in connection with paving of streets, and an equal amount in connection with the construction of sewers. We shall also probably place under contract $1,000,000 worth of work in connection with sewage disposal.

"We are making every effort possible to provide for as large amount of construction work as can be financed and properly planned and supervised."

Colorado Springs, Colo.

F. F. Mallon, City Engineer of Colorado Springs, states that: "Owing to the legal procedure necessary to promote improvement districts in Colorado Springs, it is quite impossible for us to get in shape to do any work of an improvement nature during the forthcoming construction season. Hence, it would be 1920 before we can start operations on the work we now contemplate.

"It is proposed to pave ten blocks on 17th street, so as to act as a substitute for a storm sewer. At least three or four miles of curb and gutter district will be installed. There is a reasonable possibility of Colorado avenue being paved from Colorado Springs to the Manitou connection, which embraces perhaps, 35 blocks. A decorative lighting system is to be installed between Nevada avenue and the Santa Fe depot on both sides of Pike's Peak avenue, which is about five blocks. This is as much contemplated work as we have in view at this time."

Fort Worth, Texas

F. J. Von Zuben, City Engineer, gives the following information:

"Paving or Road Building Work: The city of Fort Worth has just begun the resurfacing of a portion of Evans avenue in this city and contemplates immediate maintenance work on a number of other streets to the amount of $50,000. We are also surfacing Vickery boulevard and North Twenty-fifth street with asphalt (graveled roads), and paving the connecting link between East Front street and the Dallas Pike; North Main Street viaduct; North Houston and North Commerce streets with vitrified brick. All of these jobs are being done by contract on the cost plus basis.

"Waterworks and Sewerage: The addition to the water works filtration plant consisting of four 1,250,000 gal. rapid sand filters, together with the necessary equipment and additional sedimentation basins, aeration basin and chemical house, is rapidly being completed. This addition practically doubles the output of our water purification plant, and will make a marked improvement in the water furnished.

"Regarding the sewage disposal plant, will advise that it is the intention of our Board of Commissioners to submit a bond issue for sewage treatment works at the coming election in April."

Board of Water Supply, City of New York

J. Waldo Smith, Chief Engineer, writes:

"During the present year we shall continue work on the Schoharie tunnel and the force engaged will be materially increased as the shafts reach grade and as the tunnel excavation is begun. (The Schoharie tunnel is 18½ miles long and will be excavated from one portal and eight shafts.)

"Additional work on the Schoharie project includes the Gilboa dam, an overfall masonry structure 1,500 ft. long, having a maximum height of about 160 ft. The masonry dam will be flanked by an earthen wing dam 500 ft. long. New highways around the Schoharie reservoir will have a length of about 12 miles, and it is now anticipated that, under favorable conditions, all parts of this project will be under way during the coming season."

Water Division—City of St. Louis

Edward E. Wall, Water Commissioner, St. Louis, writes:

"The construction work proposed in the Water Division of the city of St. Louis for the year 1919, will consist merely in the completion of contracts already let and under way; namely, reconstruction of the boiler plant at the Baden station, involving a total expenditure of about $260,000. This reconstruction consists of the installation of eight new 350 H. P. water tube boilers, together with chain grate stokers, coal bunkers, scales, ash conveyor, etc., necessary for the complete equipment of the power plant, with automatic machinery for its operation.

"The completion of a 7 ft. reinforced concrete conduit connecting the storage basins at Baden with those at Bissell's Point, a distance of about 3½ miles, for the purpose of increasing the quantity of water which can be supplied to Bissell's Point station from the Chain of Rocks. The total cost of this work will be about $300,000. An ordinance for the appropriation of $300,000 or more will be introduced for the purpose of covering the storage basins at Bissell's Point and at Baden. It is hoped that the contracts for this work can be let early this year.

"About 100 miles of water mains that have been in service 20 years or more will be cleaned this year by the National Water Main Cleaning Company.

"These items of construction will take up all of the available funds belonging to the Water Division that can be spared from the necessary expenses of operation and maintenance, which have so largely increased in the past year as to reduce the usual annual surplus for extensions by at least one-half.

"It is not only the policy of the Water Division of this city to provide all the work for which we are able to pay during this readjustment period, but also to reinstate all men who have left us for war work in their former positions or in others equally as good."

Borough of Manhattan, City of New York

C. M. Pinckney, Chief Engineer, in giving a brief summary of the proposed construction work to be undertaken by the Department of Public Works, Borough of Manhattan, for 1919, writes:

"Up to this writing a definite policy to be pursued in the

conduct of public works has not been determined. I believe, however, you would be safe in assuming that in Manhattan Borough repaving will be undertaken to the extent of $3,000,000; sewer construction to the extent of $1,000,000, and a possible short piece of structural steel viaduct will be erected at 134th street and Riverside Drive."

Pawtucket, Rhode Island

George A. Carpenter, City Engineer, writes:

"I am obliged to say that no definite amount of work has yet been decided upon by the city government. It is quite likely that we may lay about 14,000 sq. yds. of grouted granite block pavement on a concrete base and may build about 3,400 ft. of sewers varying in size from 44 ins. to 60 ins.

"It is very probable that additional work will be done but no decision has been arrived at which enables us to give you an approximate idea of the amount."

Department of Public Works, Philadelphia, Pa.

George E. Datesman, Director, writes as follows of the improvements contemplated by Philadelphia:

"I desire to say that our plans provide for the expenditure of approximately $10,000,000. Of this sum, we plan to spend $2,250,000 on new bridges, sewers, and the abolition of grade crossings. A like sum is considered in our plans for highway improvement, and about $5,000,000 is contemplated for the improvement of the water supply.

"The amount for new bridges and sewers may be considered as available, and the sum mentioned for highway improvement is somewhat in a similar position. Some of the amount for the improvement of the water supply may also be considered as available."

Utica, N. Y.

Joseph Kemper, City Engineer, writes as follows:

"Our construction program for the season of 1919 is not settled, being dependent upon future ordinances directing work and bond issues required therefor, which will soon be introduced.

"However, it may be stated that the city will probably spend about $200,000 in new pavements and resurfacing work and about $30,000 in new sewers. It is the desire of the administration to promote all possible construction work in furtherance of the very great necessity for providing work during the reconstruction period.

"It is also expected that the first steps will soon be taken towards the erection of three new school houses."

Providence, Rhode Island

Walter F. Slade, Commissioner of Public Works, writes:

"I beg to advise that the expenditures of this department for the current fiscal year, ending September 30th, will be within the present balance of the appropriations made by the City Council as follows:

For highways	$260,236
For sewer construction and maintenance	218,325
For water works	273,432
For street cleaning	136,909
For bridges	35,265
Total	$924,167

of which about 38 per cent. will be expended for materials purchased out of town.

"On October 1st a new appropriation will be available, the size of which and the amount to be expended therefrom will be determined by the City Council."

Clarke County, Wash.

B. L. Dorman, Engineer of Clarke County, Washington, writes as follows relative to proposed county improvements during the year 1919:

"Clarke county proposes to hard surface the River Road from Vancouver to Washougal, a distance of 15 miles this year at a cost of about $350,000.

"Also at least three miles of the Pacific highway at a cost of about $60,000.

"Other improvements in road work by the County Commissioners will amount to about $120,000."

Detroit, Mich.

H. H. Esselstyn, Commissioner of Public Works, writes:

"I am submitting herewith figures covering the work done in the past year and I would estimate as a reasonable probability that at least one-third more work will be done in 1919 than the following figures show. This is due to the fact that, in the month of October, the paving and sewer work, not actually started, was ordered stopped by the Capital Issues Committee of the War Industries Board which order has, I believe, since been recalled.

Paving, new work	$2,476,246
Resurfacing and repairing	2,302,000
Public sewers	542,345
Lateral sewers	703,522

"We have an appropriation of about $6,000,000 for the construction of public sewers in the city of Detroit, which appropriation has not been available for the reason that bonds could not be sold, on order of the Capital Issues Committee, but the same will, no doubt, be available for this year's work. Should this be the case, it will furnish the necessary outlet and drainage for many lateral sewers and street and alley pavements which are of necessity being held up pending the proper drainage.

Corpus Christi, Texas

H. A. Stevens, City Engineer, summarizes conditions as follows:

"Pavements—No projects at present being considered. Water mains—Minor extensions only. Sewers—Minor extensions only. Water works—Completion of $40,000 reservoir now being constructed. Miscellaneous—Possibility of construction work being started on a plan of shore protection for our Bay Front. Nueces County—County will vote on a bond issue for constructing 175 miles of hard surfaced roads."

Salt Lake City, Utah

Sylvester Q. Cannon, City Engineer, writes:

"Replying to your letter relative to proposed construction work to be undertaken under my direction during 1919, and also as to the providing of "buffer" employment during the readjustment period, I desire to inform you that at the present time the proposed construction work for this year has not been definitely determined. However, the City Commission is preparing for a bond election which will provide for the issuance of $2,000,000 in bonds for various improvements as listed below. The election will probably be held about Feb. 20, 1919. If carried affirmatively a large part of the work will probably be completed this year. If it fails the improvements for the year will doubtless be rather limited.

"In the meantime, in order to provide employment for returning soldiers and sailors, the City Commission has authorized me to undertake emergency work. We are at present employing about 70 men, most of whom are returning soldiers, in construction of a road on West Canyon street, which will be a part of the boulevard system. When this work is completed we propose to dig water main trenches and lay water mains, employing returning soldiers and sailors as far as possible. This work will probably provide employment for most of the men until other improvements are definitely started.

"The general program proposed under the bond issue is in general as follows:

"For a large water supply conduit of reinforced concrete, leading from the mouth of Parley's Canyon to the N. E. portion of the city, and for various cast iron feeder water mains throughout the distributing system $500,000

"Securing additional water rights by exchange or purchase and the development of sources of local

supply	$250,000
"The conservation and development of the City Creek water supply (additional reservoir)	100,000
"Storm sewers throughout the various portions of the city	226,000
"The city's portion of sanitary sewers	50,000
"Three permanent bridges over the Jordan River and Surplus canal	35,000
"The city's portion of about 15 miles of street paving, including the lowering of water mains	250,000
"The city's portion of sidewalk improvements	20,000
"The city's portion of curbing, guttering and grading of various districts including the lowering of water mains	100,000
"Municipal bathhouse at Warm Springs and parking of grounds	200,000
"Liberty Park improvements and buildings	97,000
"New parks and boulevard improvements	35,000
"City cemetery improvements	27,500
"City's contribution to the Soldiers' and Sailors' Memorial	100,000
"Comfort Station, business district	9,500

Lincoln, Neb.

Adna Dobson, City Engineer, writes:

"It is impossible to give any definite idea of the probable amount of construction work to be undertaken by the city during the year 1919. A great deal depends on the cost of labor and materials. A large amount of pavement will be laid if the price is not considered out of reach. In our city no paving can be undertaken until a petition is filed, signed by a majority of the property owners in the district. A great many districts are under consideration, but no petitions have yet been filed.

"Under ordinary conditions we would probably lay 100,000 to 150,000 sq. yds. of pavement, costing approximately $200,000 to $250,000, and we hope that conditions will permit of our doing this amount of work the coming year.

"The only construction definitely decided upon is the construction of some storm sewers amounting to about $12,000.

"A very large amount of county road construction is under consideration, and unless the price is considered excessive, we will have a very large mileage of county paving during the coming year. It is impossible to make a definite estimate this early in the season. Within the next 60 days a great many of these projects will develop and we can form a better idea of the amount of work which will be done."

Charleston, S. C.

J. H. Dingle, City Engineer, writes:

"We are advertising at present for bids for 20,000 sq. yds. of sheet-asphalt pavement. Other work will probably be advertised later, depending in a great measure upon bids received at the present call."

Oil City, Pa.

B. B. Weber, City Engineer, writes:

"We expect to construct about two miles of sewers, from 6 to 12 ins. in diameter, about one mile of cast iron water mains, and build a new boiler house and boilers at the water works pump station. Oil City did so much paving a few years ago that we are not planning any new work of that kind, but there will be considerable expenditure for maintenance."

Passaic, N. J.

Colin R. Wise, City Engineer, writes:

"In view of the cessation of war industries and the consequent throwing out of employment of thousands of war-workers, to which number must be added the thousands of demobilized soldiers, our Board of Commissioners believe, that in order to assist in bridging the gap between war demobilization and peace mobilization, which latter will take some time to effect, it is best to proceed at once with street and sewer work, deferred on account of the exigencies of war, and so we will lay about 21,000 sq. yds. of sheet-asphalt, and 1,200 sq. yds. of granite pavements at a cost of about $77,500.

"We will also build about 5,000 lin. ft. of sewers from 8 in. to 30 in. in diameter. This work includes connections with the main intercepting sewer of the Passaic Valley sewerage commissioners. The cost of this work will approximate $82,500.

"In addition to the above this city will expend about $50,000 as its share of the cost of eliminating the grades of two streets where they cross the tracks of the D. L. & W. R. R. Co., the total cost to city and railroad approximating $375,000."

Washington, D. C.

The Engineer Commissioner of the District of Columbia, writes:

"Appropriations are now available for the erection of a number of municipal buildings, but it is impossible to proceed with the work at this time as the limits of cost fixed by Congress were based on pre-war estimates. The amount of money available for building construction is approximately $1,000,000, but at present prices of labor and material the work authorized will cost approximately double this amount. It is hoped that it may be possible to undertake the work in the near future, but this is contingent upon a decided change in the price of labor and material or upon the granting by Congress of authority to disregard the present limits of costs, or to a combination of the two.

"For the construction of new streets and roads there is available approximately $650,000 and about half as much is available for sewer work. In the highway and sewer work the Commissioners are also somewhat handicapped by the fact that specific appropriations were in many cases made for specific items of work, which cannot be undertaken at the present price of labor and material. Such work as can be placed under contract will be undertaken in the near future."

Spokane, Wash.

A. D. Butler, City Engineer, writes:

"We have under contract at the present time the paving of 14th avenue, from Grand Boulevard to Monroe street, the contract price for which is $34,000. Also, Trent avenue paving, from West Trent avenue bridge to vacated Grant street, the contract price for which is $15,500.

"At the present time I do not know of any improvements other than these mentioned that are likely to go through. It was proposed this winter to start the construction of a downtown intercepting sewer. This office prepared plans and specifications for this improvement, but at a hearing held Jan. 20, before the City Council, the improvement was indefinitely postponed."

Fargo, N. D.

W. B. Stevenson, Acting City Engineer, writes:

"We have under construction at the present time a portion of the trunk sewer system upon which work was commenced in 1917. There remains about $15,000 worth of work under this contract which will undoubtedly be pushed to completion during the spring and summer months.

"There are at present no other projects either in paving, sewer or water construction work, but we have several jobs of paving which are needed and which I hope to see under way before spring work opens up. These include 26,000 yds. of new paving, 13,000 yds. of resurfacing and about 8,000 yds. of repair work, which will include replacing base and surface. In addition to this there is probably about $25,000 worth of water mains and lateral sewer work.

"The public officials remain uncertain about new construction work for the purpose of furnishing employment during the transition period from war conditions to peace and in fact have expressed their unwillingness to undertake any new work on account of the present high price of labor and ma-

terial. However, we hope to overcome their indifference to the problem that is present. I personally have been endeavoring to overcome the indifference of public officials to this class of work and we hope to take the matter up more fully at the meeting of the North Dakota Society of Engineers, which meets at Valley City, N. D., Jan. 30 and 31."

Board of Public Service, City of St. Louis, Mo.

W. W. Horner, Chief Engineer, Sewers and Paving, writes:

"About two months ago St. Louis began preparation of a program for public works to be paid for out of the proceeds of a municipal bond issue. The city's indebtedness is limited to 5 per cent. on the assessed valuation, but the outstanding bonds are so small that it is still possible to issue $23,500,000. The mayor appointed a committe of representative citizens to act with the members of the Board of Public Service in passing upon the need of funds for construction as presented by the various departments. The total budget submitted amounted to $38,000,000 for the immediate needs, and $93,000,000 for all projects suggested. The committee has tentatively reduced the $38,000,000 requested to within the allowable limit, and its program now contains the following items:

River des Peres, main drainage	$10,495,000
Parks and playgrounds	2,850,000
Sewers	3,420,000
Municipal auditorium	1,000,000
Municipal farm	400,000
Free bridge approach (additional southwest)	1,100,000
Belt railroad and docks	1,900,000
Street opening and widening, city's share	750,000
Grade crossing elimination, city's share	1,034,000
Fire engine stations	250,000
Bellefontaine farm	150,000
Additional jail cells	85,000
Total	$23,384,000

"It is expected that the committee will finish its work within the next ten days, and that an ordinance will be submitted calling for a special election to authorize the bond issue, which election cannot be held until about June 1. Allowing a reasonable time for the sale of the bonds and the passage of particular ordinances, and of advertising for bids, it is evident that no contracts could be awarded before September. On account of the shortage of engineering employes many of our designing offices have been practically closed down, and a great deal of engineering work remains to be done on all of these projects. I should say, therefore, that the proposed bond issue presents large possibilities for the year 1920, and a portion of it may be under way in the fall of 1919. In addition to the proposed bond issue work, the city has now authorized and lying on the shelves, projects for sewers and paving amounting to probably $1,500,000. There is no obstacle to the putting of this work under contract in the immediate future if conditions warrant. The administration, however, is in a peculiar position as to this work for the reason that while it is highly advisable, in order that construction business may be revived and employment offered for the returning soldiers, yet, on the other hand, the cost of this work will be very high, and will not be borne by the general public, but will be taxed directly against the property immediately benefited. The carrying out of much of this work is of immediate importance to the city as a whole, and will be of considerable value to the property taxed, but at the high prices at which it probably will be let these taxes will, in many instances, be from one-third to one-half of the market value of the land.

"In order to secure more definite information, we are now preparing to receive bids on about March 1, for paving work amounting to about $500,000, and about $100,000 worth of sewer work. Some of this work undoubtedly will be awarded, regardless of price conditions, and if there is an appreciable decrease from last year's high prices we hope to be able to put all of it under contract. A marked decrease in price would enable the letting of still additional work which we now feel that cheap property in the outlying districts cannot pay for.

"On the whole I should say that there is a possibility of carrying a very good program this year, and a very good probability that the year 1920 will see one of our biggest construction programs."

Oshkosh, Wis.

George Randall, City Engineer, writes:

"Improvements proposed for the city of Oshkosh for the season of 1919 are as follows: Pavements, 15,000 sq. yds.; 7,500 lin. ft. of cement curb and gutter. Sewers, 1,000 lin. ft. of 15-in. pipe sewers; 300 lin. ft. of 12-in. pipe sewers. Bridges, 1 bridge across Fox river, lift bridge, will probably cost about $175,000."

Albany, N. Y.

Frank R. Lanagan, City Engineer, writes:

"The construction work to be undertaken in Albany during 1919 depends upon competition in bidding and the ability of contractors to obtain materials and common labor. The work contemplated at this time includes the construction of two public schools and about 136,000 sq. yds. of pavement construction, divided as follows: Redressed granite block, 62,500 sq. yds.; dressed granite blocks, 8,500 sq. yds. and asphalt, 65,000 sq. yds. In connection with the pavement construction there will be curbing and concrete sidewalk work. No decision has yet been reached as to what sewer work will be undertaken, but a trunk sewer about a mile long from 30 to 60 ins. is in contemplation, besides the laying of a number of local sewers of 12, 15, 18 and 24 ins. in diameter."

Seattle, Wash.

A. H. Dimock, City Engineer, writes as follows on proposed construction work:

"Water Supply: We expect to let contracts at an early date for the extension of the Volunteer Park Reservoir and for the construction of an impounding reservoir at Swan Lake, together with an outlet tunnel therefrom. The total cost of the work which will be under way in the near future will be about $1,500,000, this being the initial construction of extensions to cost approximately four million dollars.

"Power Plant: It is not likely that any large expenditures will be made in this connection this year, the work being confined to its preliminary phases.

"Sewers: A considerable amount of sewer construction will be undertaken in the near future, amounting probably to $1,000,000.

"Main Thoroughfares: The amount of this work to be undertaken during the year will probably be about $2,000,000.

"Bridges: Bond issues providing for the construction of bridges in the amount of $1,650,000 are being submitted to a vote of the people in March.

"Miscellaneous Improvement Work: Probably two or three million dollars. Construction work has been greatly curtailed during the past year, being less than one-half of that in the preceding year. In the meantime the city has been growing rapidly, so that extra efforts will be necessary in order to catch up. The only obstacle in the way to a large program of construction is the prevailing high prices."

Water Department, Baltimore, Md.

Walter E. Lee, Water Engineer, writes:

"The Water Department of the city of Baltimore will either design, install or construct during 1919, the following work which has been postponed by war conditions:

"Immediate installation of 32 operating tables for Montebello filters, contract having been awarded the American Water Softener Co., of Philadelphia, at $23,500.

"Immediate installation of 30, 36 and 48-in. suction mains

to improve operating conditions in Mount Royal Pumping Station, Baltimore, at the estimated cost of $30,000.

"Commencing immediately, the installation of approximately 20 miles of water mains of various sizes and the installation of house connections at a total cost of $100,000 in advance of improved paving.

"Immediate issuance of specifications for furnishing and erecting a 30,000,000 gal. centrifugal pump, driven by a steam turbine having water works condenser, at approximate cost of $75,000.

"Probable erection of experimental filters for comparing efficiency of mixing coagulants at Montebello filters.

"Immediate preparation of plans for new filtration plant of a capacity of 120,000,000 gals. per day, as an addition to the existing filtration plant of 128,000,000 gals. per day capacity."

Jackson, Mich.

A. W. D. Hall, City Manager, writes:

"Our 1919 budget was completed on Oct. 15, 1918, at which time the government was requesting all municipalities not to plan on any public work so that it would be impossible to plan on doing any public work in this city except through the issuing of bonds at the spring election.

"It is possible that we will do a certain amount of work, the payment of which shall be taken care of by a bond issue, however, we have not decided upon this as yet."

South Bend, Ind.

Frederick J. Anderson, City Engineer, writes:

"It is difficult for us at the present time to make any estimate as to the amount that will be done.

"We have under consideration at this time about 135,000 sq. yds. of paving, but the proceedings have not advanced far enough to enable us to tell how much of this will actually be constructed. Petitions for pavements are coming in rapidly, however.

"Very few petitions are being received for sewers, and those that are being received are for short sewers requiring small pipe."

Kansas City, Kan.

Wm. Barclay, City Engineer, writes:

"Practically all grading, curbing, paving and sewer work is originated by petition, so it is not easy to forecast probable work for 1919. State law limits amount of curbing and paving to $300,000 for any one year. This will not likely be reached; grading possibly will reach $40,000, and sewer work, $50,000. About $25,000 will be a fair estimate for bridge and culvert work."

Kalamazoo, Mich.

A. Lenderink, City Engineer, writes:

"The program for the year's work has not as yet been definitely decided upon, but the following is an estimated report:

"Pavements	$125,000
Water extensions	40,000
Sewer extensions	60,000"

Ogden, Utah

Joseph M. Tracy, City Engineer, writes:

"I cannot give you anything definite upon our proposed construction program for this year, but it seems very likely that the program I will list below will be carried out. It will be necessary for the city to call a bond election to cover a portion of the cost of these improvements if they are undertaken this year. I will state that I am in sympathy with this movement for 'buffer' employment at this time, especially during the readjustment period, and it is the aim and intention of the city of Ogden to do a maximum amount of construction work during 1919 and 1920. Following are the proposed public improvements for Ogden City, Utah, for the years 1919 and 1920:

"Paving: Forty-one blocks of paving, kind of pavement not being determined at this time, with an estimated yardage of 193,430, at a total cost of $613,262.55. This, of course, includes curbs and gutters and sidewalks.

"Municipal Lighting and Power Plant: It is proposed that Ogden City construct and operate a municipal light and power plant. Nothing definite as to whether the plant will be a steam or a hydroelectric plant has been decided at this time, but the engineering department is gathering information and data on the subject and will no doubt submit a plan to the Board of Commissioners in the near future. This proposition, however, is not definite as yet.

"City and County Building: Matters are now shaping themselves and I can state with almost certainty that the city and county will proceed immediately to construct a city and county building at an approximate cost of $500,000.

"In addition to the above it is proposed either to build a monument or construct some useful structure, such as a gymnasium, in honor of the soldiers from Ogden and Weber county who took part in the war which just closed. These structures are most likely to be built this year, but cannot as yet state definitely just what will be done."

Bay City, Mich.

H. C. Thompson, City Engineer, writes:

"We have not ordered any work for this season, but I am going to recommend an appropriation of $80,000 for permanent pavements, $20,000 for resurfacing brick pavements and $40,000 for sewers."

Cheyenne, Wyo.

E. W. Glafcke, City Engineer, and Water Commissioner, writes:

"This city is figuring on the laying of about 5,000 ft. of 4, 6 and 8-in. cast iron pipe. This will be an extension to our present system and will provide water for new additions recently made to the city.

"On account of the great demand for houses for renting and home purposes meetings have been held by the Industrial Club and other organizations, in which plans have been made for the construction of 30 to 40 residence and apartment houses to be rented or sold on easy payments. If this is carried through it means further extensions of water and sewer service.

"A report has been made by this department on the necessity of enlarging our outfall sanitary sewer mains. At present they are carrying about all they were designed to carry. This may bring about the construction of a combined storm and sanitary sewer, large enough to care for all storm and sanitary sewer, large enough to care for all storm waters as well as the sewage of the city for some time to come. Furthermore, the paving proposition has been agitated by the business people, and they are ready to put up the necessary money to pave as soon as storm sewers are constructed. The city and county are constructing a new building at a cost of $200,000, which is expected to be finished in the next six months.

"The Hyand's fireproof business block, costing $250,000, will also be finished by July 1. The Union Pacific Railroad Company is to expend this year $1,500,000 in the construction of new shop buildings, with the expectation of employing 600 additional men. The Colorado & Southern are contemplating the erection of an addition to their new 10-stall roundhouse, and a new shop building at a cost of $75,000. Purchases have been made by a large number of our people of residence lots, for the purpose of building homes this summer. Consequently the outlook for 1919 is better for all construction work than I have ever seen it here."

Augusta, Ga.

Nisbet Wingfield, who recently resigned his position as City Engineer and Commissioner of Public Works of Augusta, to open an office in that city as Consulting Engineer, writes:

"Before leaving the city I worked out a paving program for the year 1919, which called for the construction of approxi-

mately $300,000 worth of paving on several streets. One-third of this was to be paid by the city out of the general tax fund, and two-thirds by the abutting property owners. Whether or not this program will be carried through in its entirety, I cannot say, but I am satisfied that at least 60,000 yds. of concrete pavement will be put down; in fact, this work is now under way.

"I am very much in sympathy with the movement to inaugurate all construction work possible during the readjustment period. I believe, however, that for several months the amount will be limited on account of the uncertainty as to prices of material and labor; many municipalities as well as individuals are purposely delaying work with the hope that both labor and material will decline in cost. If the looked for decline does not occur several months must elapse before it is recognized that the present prices are stable.

"My own opinion is that prices will gradually decline for two or three years and I believe that the public generally will soon realize the fact that nothing material is to be gained by putting off improvements indefinitely."

Albuquerque, N. M.

C. B. Beyer, Acting City Engineer, writes:

"Our interest at this time centers chiefly upon the paving question, and we have under consideration a tentative project of some twelve miles, to include the more important thoroughfares of the city, involving an expenditure in the neighborhood of $350,000. Preliminary surveys and gathering of cost data are now under way, but no real action has been taken in the matter as yet. However, we hope to see dirt flying upon part of this project at least before next fall.

"A city plan is another of our proposed undertakings for the year. Should Albuquerque adopt such a plan, the data and other necessary information will doubtless be worked out in conjunction with our paving program.

"Should the above plans not materialize, our actual work will, owing to the city's financial status, be confined necessarily to maintenance of present equipment. Several minor projects, however, will be undertaken at the very earliest possible moment, including: Partial reconstruction of Coal avenue viaduct; three new wooden bridges, and co-operation with Bernalillo county in establishing Rio Grande Park.

"From present indications Albuquerque is scheduled to witness the greatest era of building in its history. Lack of modern residences and buildings has made itself evident, and the outlook is exceptionally cheerful.

"We are heartily in accord with the 'employment to service men' idea and have put our belief into actual execution. Every department head under this administration believes Uncle Sam's men deserve first consideration in the post-war adjustments, and that's what they will receive here."

Street Department, Worcester, Mass.

J. C. Blake, Street Commissioner, writes:

"We are contemplating doing quite an amount of work during the year 1919, not only in the way of paving, but in construction and maintenance as well. Previous to the signing of the armistice we had been called upon by the United States Government to give an approximation of the amount of work and kind of work we intended doing during 1919. After the armistice was signed, as you well know, the ban was raised, and it made a complete change in our program for this year.

"We expect to spend during 1919 in paving about $125,000, but are unable at the present time to give you any particular location where this amount of money will be expended.

"In construction (making private streets public and constructing same), we expect to do the widening of Belmont Hill, which fills in the break from the new Lake Quinsigamond bridge to Shrewsbury street. This will call for an expenditure of about $150,000 in a special appropriation. We are undecided at the present time just what we will use in the construction of the hill, in the way of paving. We are also contemplating constructing that portion of Park avenue between Mill and Stafford streets, which, if done, will mean quite a little construction job. This would mean probably an expenditure of $200,000 in construction, altogether.

"We also expect to do quite a little macadam paving, but we are wholly in the air on this amount at present, owing to the fact that the City Council has not passed any orders for this kind of work as yet.

"We expect to do quite a good deal of maintenance work in the way of Topeka Top: Lincoln street, 9,600 yds.; Southbridge street, 9,000 yds.; Salisbury street, 12,000 yds., and a few other minor streets that may be done during the year."

Ft. Wayne, Ind.

F. M. Randall, City Engineer, returns the following report:

"Pavements, $250,000; bridges, $5,000; water works, $200,000; sewers, $10,000. Much more in sight."

Cincinnati, Ohio

F. S. Krug, Chief Engineer, gives the following list of proposed street and sewer improvements. He advises that these improvements either are under contract or about to be let, and the bulk of the work will be done during the present year.

STREETS UNDER CONTRACT

	Yardage		Cost
Eastern Avenue	13,600	Granite	$106,972.00
Freeman Avenue	17,600	Granite	104,221.00
Central Avenue	22,700	Wood Block	151,765.00
Madison Road	61,700	Bit. & Brick	309,236.40

PROPOSED STREET CONTRACTS

Harrison Avenue	14,200	Granite	87,965.50
Hamilton Avenue	21,500	Brick	90,000.00
Jones Street	2,900	Bitulithic	20,352.50
Grand Vista Avenue	1,650	Concrete	5,684.00
Elsinore Place	1,400	Bit. Macadam	6,339.50
Haven Street	2,460	Concrete	14,893.50
Turrill Street	3,000	Asphalt	19,169.50
Verdin Aveune	3,350	Brick	16,989.84
Verne Avenue	4,050	Brick	22,000.00
Davey Avenue	1,950	Bit. Macadam	7,500.00
Davoran Street	820	Concrete	5,000.00
Minion Avenue	2,750	Concrete	12,500.00
Gilsey Avenue	1,750	Bit. Macadam	10,000.00
			$990,588.74

SEWERS UNDER CONTRACT

	Length		Cost
Rulison Ave., etc.	6,235 ft.	8 in.—22 in.	34,150.00
Paxton Avenue	4,677 ft.	15 in.—93 in.	41,908.00

PROPOSED SEWER CONTRACTS

Gladstone Avenue No. 1	2,020 ft.	12 in.—18 in.	11,080.00
Ballard Avenue	1,635 ft.	27 in.	26,910.00
Clifton Avenue	420 ft.	22 in.	7,500.00
Gladstone Avenue No. 2	2,100 ft.	12 in.—15 in.	12,500.00
Ravine S. of Ridgeway Ave.	1,825 ft.	30 in.—48 in.	22,000.00
Highland Avenue	845 ft.	12 in.—22 in.	8,500.00
Madisonville No. 4	54,265 ft.	8 in.—48 in.	330,000.00
Mill Creek	19,896 ft.	8 in.—87 in.	870,000.00
			$1,364,548.00

Oak Park, Ill.

W. F. Sargent, Commissioner of Public Works, submits a statement showing what Oak Park contemplates in the way of street pavements and other public improvements during 1919. Only the summary is here given.

In addition to this Oak Park has tentative plans for improving about two miles of street in addition to that noted herewith:

Item			Cost
Street pavements	Contract let, sq. yds.	6,878	$27,810.00
Street pavements	Pending in court, sq. yds.	25,064	89,536.00
Street pavements	Contemplated, sq. yds.	81,123	361,992.00
Alley pavements	Pending in court, sq. yds.	5,604	14,054.90
Sewers	Contemplated, sq. yds.		11,833.00
Total		118,669	$505,225.90

Davenport, Iowa

The Board of Public Works is asking outside contractors to bid on a big program of street paving on Feb. 18, until 2 p. m. Bids are to be on asphaltic concrete, brick or bitulithic, on 63 systems of streets. The total estimated cost is about $851,000. Hugo Moeller is city clerk. Harry W. Phillips, Commissioner of Public Works, and Roscoe Sawistowsky is City Engineer.

Jersey City, N. J.

C. A. Van Keuren, Chief Engineer, Department of Streets and Public Improvements, states that estimates have been prepared for paving to cost $1,400,000. The total yardage is 363,810. The work comprises new construction and resurfacing with all the standard types of materials.

Los Angeles, Calif.

W. T. Knowlton, Engineer of Sewers, reports much prospective sewer work, aggregating 443,123 ft. of sewer. The length for various sizes follows: 6 in., 48,770; 8 in., 161,511; 10 in., 21,900; 12 in., 10,900; 15 in., 5,692; 18 in., 13,700; 21 and 24 in., 5,550 ft.

Astoria, Ore.

R. A. McClanathan, Deputy City Engineer, reports the following work to be done this year:

Building sea wall and filling tide flats.....$400,000
Street improvements, grading and paving..... 150,000
Sewers, reinforced concrete and tile..... 100,000

Board of Local Improvements, City of Chicago

M. J. Faherty, President of the Board of Local Improvements, sends us a letter to him from James T. Igoe, city clerk, and answers to this letter from Sewer Engineer C. D. Hill, Chief Street Engineer J. G. Gabelman, and Superintendent of Sidewalks N. E. Murray.

The letter from Mr. Igoe to Mr. Faherty follows:

"At a meeting of the Committee on Streets and Alleys, held Wednesday, Jan. 15, 1919, I was directed to request you to supply the following data and any other information which will throw light upon the objects discussed by said committee relative to public improvements:

"1. The amount of paving, sewer and sidewalk construction which the board intends to begin and finish this year.

"2. The amount of such work which will be ready when the construction season opens.

"3. The amount of such work which will be ready by June 1.

"4. The amount of such work which you intend to start after the last named date.

"5. The amount of work which you will have on Feb. 1, on which you will then be ready to award contracts.

"6. The same information in regard to other improvements under the jurisdiction of the board.

"7. Your opinion on whether the above program should be increased, and the extent to which it should be boosted, together with the reasons therefor.

"8. The board's program for supplying work during the period of demobilization.

"9. The difficulties in detail to the carrying out of a construction program during 1919 of twice the size of your largest construction year.

"10. Any other suggestions and information you deem pertinent."

The answers to Mr. Igoe's questions as returned by Mr. Hill, Sewer Engineer, follow:

"1. We expect to begin and finish sewer construction to the amount of $700,000 during the present year.

"2. Of such work about $400,000 is the amount that will be ready when the season opens.

"3. Of such work about $500,000 is the amount that will be ready by June 1.

"4. Subsequent to June 1 we expect to let contracts to the amount of about $200,000.

"5. About $400,000 is the amount of work that will be ready for awarding contracts on Feb. 1.

"6. This department has a large program of street openings, which, however, will not result in any considerable amount of construction work during the present year.

"7. In my opinion the board should push proceedings for local improvements where the property owners can afford to pay the cost.

"8. The board has no program other than starting proceedings for local improvements and carrying the same through to completion.

"9. The principal difficulty in carrying out of construction program during 1919 of twice the size of our largest construction year is in getting property owners to consent to assessments, which must necessarily be very high. Much of the real estate of the city is in condition that makes any special assessment oppressive.

"10. I believe that one kind of improvement that is urgent and that involves only light assessment on property benefited is the construction of large relief sewers. These sewers are urgently needed, and as a rule the assessment would be but slightly above $1.00 a front foot on the property benefited."

The answers of Mr. Gabelman to the questions follow:

"1. The amount of paving work which we will probably begin and finish this year I estimate to be about 1,900,000 sq. yds. This, of course, depends on how fast the courts work in confirming assessments, and also on whether estimates are stayed at publish hearings, Council, etc.

"2. The amount of paving work which will be ready when the construction season opens will be about 770,000 sq. yds.

"3. By June 1, 250,000 sq. yds. more or about 1,020,000 sq. yds. will be ready.

"4. The amount of work which we intend to start after June 1 will be about 950,000 sq. yds. Some of this work will probably not be completed this year, depending somewhat on the condition of the weather late in the fall.

"5. The amount of work which we will have ready on Feb. 1 will be 384,500 sq. yds.

"6. This does not apply as to street paving.

"7. In my opinion the above program should be increased to about twice the present amount. My reasons therefor are that there are many streets in the city which are not paved which should be paved on account of traffic conditions. Other streets and alleys should be paved on account of the comfort and health of the general public, and for fire protection.

"8. This division is making every effort to hurry its work along so that we may aid in supplying the work during the period of demobilization.

"9. The difficulties in detail to the carrying out of a construction program during 1919 of twice the size of the largest construction year are principally lack of funds, as a larger force would have to be employed, and the fact that orders are not in at this time for enough work to carry out a program of twice the size of our largest construction year. We could, however, increase our program materially if an effort were made by the Council and the Board at this time to order the improvement of more streets and alleys.

"10. There are pending in the Council at the present time as referred, deferred or filed, proceedings for streets amounting to 500,800 sq. yds., and 36 alleys amounting to approximately 36,000 sq. yds., or a total of 536,800 sq. yds. If the Council will pass the ordinances for these streets and alleys they will aid materially in increasing the amount of work done in this department during 1919. I understand a large number of these proceedings are in the hands of the Committee on Home Defense."

N. E. Murray, Superintendent of Sidewalks, reports proceedings for sidewalks as follows:

"1. Projected improvements in course of preparation for ordinances on 1,929 streets, totaling 435.49 miles.

"2. Ordinances passed on which assessment rolls have not been filed on 591 streets, totaling 133.42 miles.

"3. Assessment rolls filed in court and not yet confirmed on 215 streets, totaling 48.52 miles.

"4. Assessments confirmed on which contracts can be let whenever ordered, on 900 streets, totaling 203.18 miles.

"5. Contracts let, work not done on 117 streets, totaling 26.49 miles. Total, 1,047.10 miles.

"The only work that is likely to be done this year under Class 1 will be such ordinances as are passed under special taxation.

"The amount of work that can be done under Class 2 will depend entirely upon when the assessment rolls are filed and confirmation obtained.

"There is no reason why all the work under Classes 3, 4 and 5, totaling 278.19 miles, cannot be done this year, if the City Council provides a sufficient number of inspectors and engineers to look after the work. Based on present prices, the cost of work in Classes 1 to 5, inclusive, will be approximately $6,000,000."

Twenty-five State Highway Engineers Report Their Plans for 1919

Letters follow from twenty-five engineers of as many state highway commissions, giving their plans for the coming construction season in some detail. These letters to the editor are fairly representative of conditions throughout the country. That this is to be a great year for highway workers no one can doubt who will read these letters.

Colorado

J. E. Maloney, Chief Engineer, State Highway Commission, Denver, gives the following general facts concerning proposed road expenditures in Colorado in 1919:

"The total State fund available will be $1,000,000. The counties will have available from their direct tax levy, for roads and bridges, $2,000,000. There will be available from the United States, Federal Aid amounting to $320,000. The counties will contribute about $500,000 from the County Road fund for the maintenance and construction work on the State Highway system. This will make available for the State Highway system a total of $1,800,000 from all sources. The State Highway system comprises 7,200 miles of road; while the County Road system would be 35,000 miles. Upon the State system, the maintenance of present mileage of road including repairs to bridges and culverts, will take about one-half of this total fund; the balance being devoted particularly to improvements, re-locations, and new constructions of roads and bridges.

"The Commission has authorized the construction of 11 miles of hard surfaced road pavement in short stretches from ½ to 2 miles in length in the vicinity of the following cities: Denver, Greeley, Boulder, Longmont, Sterling, Fort Morgan, Colorado Springs, Pueblo, Rocky Ford, La Junta, Delta, Montrose and Grand Junction; this work contemplates an expenditure of about $250,000. Ninety thousand dollars will be expended upon the improvement of the Big Thompson Canon Road in Estes Park and $60,000 upon the completion of the Fall River Road above Estes Park in the Rocky Mountain National Park.

"It is estimated that $350,000 will be expended on the great North and South Highway, south from Pueblo to the New Mexico Line; this improvement will include surfacing and construction of bridges.

"Additional construction work will be done at the following points near Wray, Lamar, Fort Collins, Ouray, Blue River Road, San Miguel County near Craig and in Eagle County. The estimated costs of these various pieces being about $125,000. In addition to this work, the County Road fund will be used to some extent in the construction of new work and bridges on the County Highways of the State, details of which we have not at present in our possession."

Connecticut

Charles J. Bennett, State Highway Commissioner, Hartford, gives this brief summary of highway construction work to be undertaken in Connecticut in 1919:

"We are planning to spend during the coming season approximately $4,000,000 for highway construction purposes, this work to be done in the construction and maintenance of highways and bridges. Possibly we will be unable to spend the entire sum, but we are going at the work with an idea of carrying on a very busy campaign for the improvement of highways in this State. Certainly, I believe that now is the time to build up our highway systems.

"I hope for slight reductions in the price of labor and materials which will allow us to carry forward this work."

Delaware

Charles M. Upham, Chief Engineer, State Highway Department, Dover, advises that there is approximately $1,300,000 in contracts left over from 1918. His letter continues:

"The first step in our program for 1919 will comprise approximately 51 miles of roadway in different parts of the state. This will be let at different times during the early part of the year. As soon as this work is under contract and if the material and labor supply is then adequate, a supplementary program will be undertaken which will comprise approximately the same amount of work as the first part of the 1919 program. The contracts will range in length from ½ mile to 10 miles, so there will be opportunity for contractors with different sized plants and equipment.

"Besides the State program for 1919 it is expected that there will be considerable County work carried on. At the present time there is available for the County program, bond issues to the amount of $1,000,000.

"Road work in Delaware was put on a firm foundation with the creation of the State Highway Department, and the first year's program was seriously impeded by the conditions that prevailed during the time our country was at war, but with the reconstruction period about to commence, it is expected that Delaware will quickly construct her highways and carry on a large program."

Georgia

W. R. Neel, State Highway Engineer, Atlanta, writes:

"We have no idea just what will be the amount spent on road construction in Georgia this year, but I am sure it will be our biggest year by far.

"The usual three or four million dollars spent by counties is assured and there are also several bond issues now being agitated, aggregating about four millions more.

"The Highway Department has proposed the increase of the automobile license fee and requested a Constitutional amendment which will allow the State to issue bonds to be retired with this proposed increased automobile fee.

"This seems to meet with unanimous approval and will, I think, become a law shortly after the General Assembly meets this June.

"What I am striving for is action *now* in order to give employment to everyone needing it."

Illinois

Clifford Older, Chief Highway Engineer, Springfield, writes:

"The construction program to be undertaken by this state this coming season will depend to a considerable extent upon conditions governing the final cost of the roads.

"Among such conditions might be mentioned: The possible reduction of freight rates. The availability and cost of labor. The availability and cost of materials.

"Granting that these conditions will be satisfactory, it will be possible for Illinois to spend:

"About $2,000,000 on state aid road construction, for which funds were appropriated by the state legislature and the several counties of the state in 1917.

"About $4,500,000 of state and federal funds on federal aid roads.

"About $2,000,000 of county funds on federal aid roads.

"In addition the people of several counties of the state have approved bond issues for the construction of roads other than those included in the above. Such county bond issues amount to several million dollars.

"We expect to have completed surveys, plans and specifications for five hundred miles or more of road by early spring. The validity of the bond issue act will be tested in the Supreme Court of the state, and at the present time it seems possible that a decision may not be rendered until June. This, therefore, may effect the total amount of construction that may be undertaken in this state during 1919."

Kansas

M. W. Watson, acting State Highway Engineer, Topeka, writes:

"Up until a short time back, Kansas has been classed in road work as one of the most dilatory states in the Union. She has been a leader in practically every other reform or progressive movement and her apparent lack of interest in the construction of hard surfaced roads is not entirely due to her backwardness, but partially to the fact that naturally we have the best earth roads in the country. The people are now beginning to realize that even as good as they are, an earth road is inadequate for modern traffic.

"Our worst difficulty is from the dry weather in the semi-arid regions of western Kansas, where the soil is very light and during extreme dry weather, the soil becomes dusty and the high winds blow away the roads until they are considerably below the surrounding country.

"The legislature of 1917 provided the ammunition by which we could start a very progressive road movement, creating the State Highway Department and providing for the accepting of Federal aid and the construction of roads under the benefit district road plan. Since that time, the State Highway Commission has received applications for Federal aid covering 34 sections of highway of which 31 have been allowed and three rejected by the department.

"We have presented to the Federal Government applications for Federal aid on 22 projects, of which two have been rejected and two have not yet been acted upon by the Government.

"The entire amount of work upon which preliminary steps have been completed amounts to 344.7 miles, at an approximate estimated cost of $10,163,930. The State Highway Commission is giving to the counties 25% Federal aid and on this basis we have already filed sufficient applications to absorb the entire allotment of aid to Kansas under the present Federal aid appropriations.

"Shortly after the organization of the State Highway Commission, the war came on, which prevented any extensive road improvement, so that we have at the present time only one contract under way, which was of war necessity and extended from Junction City, Kansas, to Fort Riley and Camp Funston. This road is 1.118 miles in length and for the greater portion consists of a 20 ft. monolithic brick road, 240 ft. being of reinforced concrete over a high fill. The brick portion of this road is now completed, but the concrete portion has been held up due to a delay in the construction of a Government bridge over the Republican River.

"Bids were received on January 3d for 27.35 miles of monolithic brick road and the lowest bid received was $1,447,000. Owing to the extreme cost of the road, the county board felt it necessary to reject all bids and it may be that the type and width of this road will be changed and readvertised at some future date.

"You can see from the amount of work lined up for Federal aid that unless the excessive prices deter the board of county commissioners from awarding contracts that Kansas will have an era of road construction during 1919 which will be greater than we will be able to handle with the force of engineers obtainable at the present time. This proposed work is divided between brick, concrete, bituminous macadam, water bound macadam and gravel. The greater portion petitioned for is concrete and brick, which seem to stand in about equal favor.

"In addition to the Federal aid work, there have been petitions approved by boards of county commissioners on other than Federal aid work which will amount to somewhere in the neighborhood of $2,000,000.

"The State of Kansas, although in the past backward in road work, is now coming very rapidly to the front and within a very short period of time will be near the head of the list."

Maine

Paul D. Sargent, Chief Engineer, State Highway Commission, Augusta, writes:

"Funds now available for state highway work in Maine for 1919 are as follows:

Appropriation for state highways.....	$377,000
Federal aid arranged for and contracts outstanding and work in progress.....	200,000
Federal aid apportionment of January 7, 1919, for fiscal year ending June 30, 1920	192,000

"It thus appears that we have not sufficient state highway appropriation to take advantage of all federal aid that will be available during this year, but the Legislature now in session is giving consideration to the question of providing more funds for this work.

"Our regular appropriation for state aid work is $500,000 per year, which will undoubtedly be provided by this Legislature. Cities and towns furnish about $300,000 to go with this, and we have some $250,000 of state aid funds accruing from the last two years which have been unexpended on account of labor shortage.

"We shall have an appropriation of $100,000 of state aid for bridges, and this calls for appropriations by counties and towns of $400,000 to go with it, making possible the construction of $500,000 worth of bridges.

"We have estimated that the requirements for maintenance of state and state aid highways will be $800,000 for the year 1919, of which the towns and cities will furnish $200,000, and the state has been asked to grant $600,000.

"The above briefly outlines the activities of the state of Maine with respect to construction and maintenance of improved highways and bridges during the year 1919."

Massachusetts

Arthur W. Dean, Chief Engineer, Massachusetts Highway Commission, Boston, writes:

"We will have a considerable amount of money available for construction work this year by appropriations in previous years. The regular 1919 appropriations, however, have not yet been made by the Legislature, consequently, I cannot give you positive figures showing just what we will expend this year. We hope and expect, however, that we may have available for expenditure this year a sum equal approximately to $4,600,000 of State funds. The expenditure of this money will be divided as follows: For construction, $1,900,000; for maintenance and reconstruction, $2,700,000. In addition to these amounts, it is estimated that there will be expended, under the direction of this Commission, from $300,000 to $400,000 contributed by cities and towns, and from $100,000 to $200,000 contributed by counties. Of course, the above figures do not include expenditures by cities and towns on their own roads, which is estimated to be about $14,000,000 in a year, but in this expenditure the cities and towns are entirely independent of the State.

"Indications at the present time seem to be that in this State at least there will be plenty of labor and material available for early and continuous work through the season, although it is not expected that the prices of same will decrease much below the prices of 1918."

Mississippi

Xavier A. Kramer, State Highway Engineer, Jackson, writes:

"There is available in the various county and separate road district treasuries, approximately the sum of $3,000,000, which will be used for construction of improved roads during

this year. The work will consist largely of gravel surfaced roads.

"In addition to the above amount, bond issues for approximately $1,000,000 are contemplated and in addition thereto, there is available approximately $500,000 of federal aid.

"Prices for road work are yet very high and labor is very scarce. This department is recommending that the letting of contracts be deferred until spring.

"The construction of roads in Mississippi is largely done by means of teams, and the high cost of feed makes this feature expensive.

"The most important project under consideration is the construction of a bridge across Bay St. Louis on the old Spanish trail road. The estimated cost of this is $750,000. The State Highway Department is now engaged in making the preliminary plans for this structure and the estimates will be submitted to the local county officials within the next 60 days."

Nebraska

George E. Johnson, State Engineer, Lincoln, gives the following summary of proposed road work in Nebraska in 1919:

"We have attempted a plan which embraces 752.91 miles at an estimated cost of $165,789.07 plus $737,663.86 Federal Aid Fund, as follows:

Project Names	Counties	Length	Estimated Cost	Approximate Amt. of Federal Aid
North Platte-Sutherland	Lincoln	19.2	$43,027.97	$21,513.99
Stapleton-Ringgold	McPherson-Logan	17.1	36,216.92	18,108.46
Washington-Burt	Washington-Burt	26.3	56,331.88	28,165.94
Cedar-Wayne	Cedar-Wayne	38.2	105,676.78	52,838.39
Norfolk-Columbus	Madison-Platte	48.1	104,455.50	52,227.75
Kearney-Pleasanton	Buffalo	16.5	33,556.10	19,278.05
Litchfield-Broken Bow	Custer	35.0	74,873.70	37,436.85
Lincoln-Beatrice	Lancaster-Gage	17.95	98,615.00	25,805.64
Fremont-Ceresco	Dodge-Saunders	33.67	50,050.00	25,025.00
Seward-Aurora	Seward, York and Hamilton	50.85	103,007.57	44,861.57
Nebraska City-Plattsmouth	Otoe-Cass	27.55	57,750.00	28,875.00
West Emerald	Lancaster	4.00	19,250.00	9,625.00
Fremont-Ames	Dodge	5.94	140,000.00	18,000.00
Alliance-Antioch	Box Butte-Sheridan	14.83	96,743.79	38,635.303
Harrison-Whitney	Sioux-Dawes	40.8	67,876.85	33,938.42
Douglas County-Lincoln	Douglas	27.00	45,000.00	23,500.00
Hamlet-Imperial	Hayes-Chase	16.8	36,465.00	18,232.50
Sargent-Harrop	Custer-Loup	20.0	27,460.88	13,730.44
St. Paul-Grand Island	Howard-Hall	17.0	27,376.20	13,688.10
Genoa-Albion	Nance-Boone	24.0	42,500.00	21,250.00
Curtis-Stockville	Frontier	21.9	32,218.63	16,109 31
Allen-Ponca	Dixon	17.0	26,070.00	13,035.00
O'Neill-Butte	Holt-Boyd	41.8	83,875.00	41,937.50
Osceola-David City	Polk-Butler	26.0	66,678.14	33,339.07
		16.5		
Schuyler-Columbus	Colfax-Platte—Colfax Platte	10.6	20,000.00	10,000.00
		5.9		
Cambridge-Oxford	Furnas	32.5	34,283.00	17,141.50
Beatrice-Fairbury	Gage-Jefferson	31.12	54,972.50	27,486.25
Bloomington-Orleans	Franklin-Harlan—Franklin, 8.5; Harlan, 15.0	23.5	42,643.70	21,321.85
Rockville-Loup City	Sherman	25.3	25,113.96	12,556.98
	Totals	752.91	$1,657,089.07	$737,663.86

Montana

Paul D. Pratt, Chief Engineer, Helena, writes as follows of Montana's 1919 Highway construction program:

"It is anticipated approximately $1,500,000 will be expended on all highway projects during the 1919 season.

"On the Yellowstone Trail the main east and west highway, the principal tourist route to the Yellowstone National Park and across the state, the following projects are proposed:

"Elimination of dangerous grades on so-called Shirley Hills east of Miles City. (State Aid). Providing drainage and placing compact gravel surface on seven miles of road between Miles City and Tussler. (State Aid). Eliminating precipitous grades and narrow embankments west of Fort Keogh. (State Aid). Placing a compact gravel surface on four miles east of Forsyth. (Federal Aid). Replacing Huntley Bridge and river control at Huntley, which will permit use of main Yellowstone Trail and make it unnecessary to continue detouring over the dangerous road now travelled south of the river. (Federal Aid). Construction of a 270 ft. concrete bridge over Yellowstone River south of Livingston on the branch to the Yellowstone National Park. Replaces steel structure carried away by the high waters of June, 1918. (Federal Aid). Draining and placing compact gravel surface on three projects totaling approximately 11 miles between Livingston and the Yellowstone National Park. (Federal Aid). Paving three sections of Yellowstone Trail west of Bozeman in Gallatin County. (Federal and State Aid). Surfacing 3.3 miles of so-called Cardwell-Nigger Hollow Road, Jefferson County. (Federal Aid). Relocating, reshaping and graveling Deer Lodge to Nimrod Road, in Powell and Granite Counties. Improvement modifies grades and eliminates the dangerous Nimrod Hill. (State Aid). Relocating and reconstructing road and eliminating so-called Marshall Grade in Missoula County. (Federal Aid).

"Proposed expenditures on Red Trail east of its confluence with the Yellowstone Trail at Terry: Grading, drainage and surfacing four projects in Wibaux County, approximately 17 miles. (Federal Aid). Providing drainage, grading and surfacing 28 miles in vicinity of Glendive.

"At the present time there is no trans-state highway in northern Montana. The Highway Commission has designated certain roads for improvement and located the missing section over the Continental Divide between Glacier Park Station and Belton. Work has been started in Lincoln, Flathead, Blaine, Phillips and Valley Counties, which, when completed, will link with and form part of this northern Montana trans-state route. Work on all these projects will go forward during the coming season.

"In addition to the foregoing, there are approximately 40 projects, Federal and State Aid, on auxiliary or market highways of the state, construction of which will be undertaken as quickly as attending conditions permit."

New Jersey

W. G. Thompson, State Highway Engineer, Trenton, writes:

"Since we have not as yet received any requests from the counties of the State, we do not know how much work they intend doing, but anticipate a general resumption of highway construction and maintenance on a scale never before attempted. Including the work contracted for in 1918 and which was stopped by the restrictions of the United States Highway Council, the State Highway Department of New Jersey expects to construct during the season of 1919 approximately 100 miles of State Highways, at a total cost of approximately $5,250,000. In addition to this amount, the State will give as aid to the counties, approximately $2,000,000 toward the repair, maintenance and reconstruction of county roads, approximately $500,-

000 as aid to the counties for new construction of county highways, and $105,000 to the townships for the improvement of township roads.

"It is assumed the counties of the State will spend during the coming season approximately $3,000,000 for repairs, maintenance, and reconstruction, and new construction, in addition to the amounts allotted by the State. It will be seen, therefore, that providing able contractors and materials are available, there will be under way by the middle of the coming construction season approximately $9,000,000 worth of work in the State of New Jersey. It is expected this will be one of the busiest years that New Jersey has ever experienced with reference to highway improvement."

North Dakota

J. E. Kaulfuss, Assistant Chief Engineer, North Dakota State Highway Commission, Bismarck, writes:

"Plans have been drawn and we are ready to advertise for approximately 200 miles of new work, earth and gravel roads, amounting to nearly $350,000.

"In addition we have made surveys and are drawing plans for work to be let, if that is possible, this year, depending upon the available contractors in the state and upon the state's activity as to day labor work, for approximately 325 miles of construction similar to the above, amounting to $550,000.

"In spite of the abnormal conditions of 1918 the department was able to place about 250 miles under construction, costing about $325,000. Fifty per cent. of this work, perhaps, was completed. The remainder is to be finished at the earliest possible time this spring.

"In other words, we have in sight for 1919, 650 miles of state highway work, principally federal aid construction and earth roads, which amounts to a trifle over $1,000,000. Just how much of this we can do will depend upon two factors as previously stated, first, the number of contractors available to do this work, and second, the development of a day labor scheme, the work to be done by the counties and the state.

"We are not attempting to give you any figures on strictly county, township or municipal road and bridge work, but it is believed that not less than $2,500,000 will be spent this year by these governmental units.

Oklahoma

Max L. Cunningham, State Engineer, Oklahoma City, writes:

"It is impossible for us to give at the present time even an estimate of what will be done by this State during the next year. There is pending before the present legislature a large amount of road business, and until they settle this there is no way of even estimating what will be done, although we feel sure that 1919 will be a banner year."

Pennsylvania

William D. Uhler, Chief Engineer, State Highway Department, Harrisburg, writes as follows of the funds available for highway work during the coming season:

State highway construction	$2,900,000.00
State aid construction	1,300,000.00
Federal aid available	1,688,000.00
Estimated receipts of automobile division for the year 1919, to be used in maintenance work	5,000,000.00

"In addition to the above amounts the Legislature which is now in session will make available the proceeds from the $50,000,000.00 bond issue recently voted on in this state. No information is available as to the amount of this bond issue that will be set aside for 1919 work."

Rhode Island

Irving W. Patterson, Chief Engineer, Providence, writes:

"Definite information at this time is impossible because of the fact that our General Assembly which is now in session has to date taken no action in regard to the appropriation of funds for state road work during the ensuing year. There are no certainties at present so that all of the information which it is possible to give you at this time is in the way of reasonable probabilities.

"We have requested our General Assembly to make available $400,000 in addition to the funds received under the provisions of our Motor Vehicle Act, which we estimate will amount to about $350,000. We recommend to our General Assembly further that this total of $750,000 be spent for maintenance and reconstruction. The maintaining and the improving of our present system of state highways is the big problem in Rhode Island. All of our main trunk lines have been built, but a great deal of the old macadam laid many years ago has outlived its usefulness very largely and should be rebuilt.

"In addition to the state funds proper which may be made available for our work there is also to be noted funds due Rhode Island under the terms of the Federal Aid Road Act of 1916. Approximately $35,000 is due Rhode Island for the fiscal year ending June 30, 1919, and approximately $46,600 will be available subsequent to June 30, 1919, for the following fiscal year. State funds equal to the amounts stated are already available under the provisions of an act by our General Assembly, accepting the provisions of the Federal Aid Road Act. The Federal Aid Road fund may therefore be considered to be $163,000, roughly."

South Carolina

R. T. Brown, Assistant State Highway Engineer, Columbia, writes:

"From every viewpoint the indications are that the people of South Carolina have passed the promotional and emotional stage in relation to the importance of good roads. We are settling down now to the consideration of the means wherewith to build really good roads as early as possible.

"At present all road construction in the State is carried on with the county or township as the unit, there being no state roads and no State Aid for construction and maintenance. The State Highway Department licenses motor vehicles, returning 80% of the license fees to the counties from which collected to be spent by them on roads and bridges. The remaining 20% is used to bear the expense of licensing motor vehicles and to maintain an Engineering Department to handle Federal Aid road work.

"The total Federal Aid apportioned to South Carolina from the appropriation of 1916 is $1,077,114.60. The State Highway Commission tentatively allotted this fund by counties on the basis of area, population, assessed valuation, and mileage of proposed state roads, in order to give all counties equal chances to apply for these funds. In case any counties do not apply within a specified time the funds will be allotted on projects in other counties which do apply.

"To date there have been applications made by 29 of the 45 counties. In two counties Federal Aid Projects are practically completed, involving a total cost of about $170,000, of which $65,080.18 is to be paid from Federal Aid. Construction is in progress on two other projects involving $89,223.80, of which $42,731 44 is to be paid from Federal Aid. Seventeen other projects have been approved by the U. S. Secretary of Agriculture, making a total of 29 projects approved to date, the total estimated cost of which is $873,920.67, of which $358,586.83 will be paid from Federal Aid.

"Surveys and plans are practically completed on nineteen projects; so that considerable work can be started as soon as labor becomes available.

"On one porject for the construction of 12.17 miles of sand-clay road, for which bids were requested during 1918, no bid was received. Another project for the construction of 3½ miles of road and bridges thereon has been advertised three times within the past four months without being let. Three

bids were received, all of which were much in excess of the funds available.

"The State Automobile Association has recently inaugurated a campaign for a $25,000,000 bond issue for the construction of hard surfaced roads in the State. It is proposed to pay the interest and to retire the bonds by receipts from the licensing of motor vehicles. The Association has prepared a bill to introduce before the present legislature, authorizing such a bond issue. It appears now, however, that reconnaissance, surveys and estimates will have to be made and the roads to be built designated before the voters will ratify the bond issue. The Highway Department has outlined a proposed system of state highways which comprises more roads than could be built of high type construction with the bond issue proposed. Several of the most important highways, however, could be constructed with this fund, after which those next in importance could be cared for by other means, such as local taxes and bonds and future Federal Aid.

"While South Carolina has heretofore been classed with the most backward states in the matter of improved roads, she is now catching step with the most progressive. Her fertile farming lands and prosperous manufacturing towns and cities when inter-linked with a system of hard surfaced highways will quickly bring her into the position of one of the foremost of Southern States."

South Dakota

Frank S. Peck, Highway Engineer, Pierre, writes:

"Herewith is a list of our Federal and State Aid roads which will be built during 1919, provided the necessary contractors can be secured:

LIST OF PROJECTS APPROVED

	Amount
Codington Co., 11.24 miles, gravel surface	$47,972.10
Lincoln, Co., 10.00 miles, gravel surface	41,553.16
Grant Co., 11.83 miles, earth surface	26,963.39
Brookings Co., 6.5 miles, gravel surface	19,946.30
Minnehaha Co., 25.00 miles, gravel surface	100,608.06
Moody Co., 9.13 miles, gravel and earth	26,774.44
Deuel Co., 8.6 miles, gravel surface	28,943.38
Butte Co., 11.5 miles, earth surface	20,638.20
Brown Co., 12.85 miles, gravel surface	72,424.00
Clark Co., 14.29 miles, gravel surface	44,143.83
Total	$429,966.86

STATE AND FEDERAL AID ROAD PROJECTS UNDER PREPARATION

	Amount
Clay Co., 9.97 miles, gravel surface	$36,502.36
Yankton Co., 10.10 miles, gravel surface	47,304.88
Davison Co., gravel surface	30,388.10
Meade Co., 8.00 miles, earth surface	10,000.00
Roberts Co., 35.00 miles, earth surface	52,126.72
Stanley Co., 15.00 miles, gravel and earth surface	30,294.78
Hanson Co., 7.25 miles, gravel surface	23,880.34
Lawrence Co., 24.00 miles, gravel and earth surface	42,139.52
Pennington Co., 16.00 miles, earth surface	62,065.70
Total	$334,702.40

"We also expect to prepare a number of other prospects during the coming season. Besides this the counties and townships have levies of over $2,000,000 for road construction and maintenance."

Tennessee

A. M. Nelson, State Highway Engineer, Nashville, writes:

"I am sending you herewith a list of projects showing the counties in which they are located, the type of surface and the amount of federal, state and county aid.

"These projects will be advertised and an attempt made to let them and construct this work during the coming season.

"Our greatest difficulty previously has been the unsettled labor conditions and high prices of material, which I hope will be very much modified as the forces from overseas are returned to the United States, many of them will be seeking employment.

"You will note in this tabulation that we have segregated state aid projects from the state and federal projects."

Utah

Ira R. Browning, Engineer, Utah Road Commission, Salt Lake City, gives the following estimate of road work in Utah in 1919:

STATE ROADS

Hard Surface Roads

Ogden to Salt Lake	12 mi., at $20,000 per mi.	$240,000
Midvale Jct. to Utah Co. Line	11.4 mi., at 20,000 per mi.	228,000
Utah Co. Line to American Fork	8.2 mi., at 20,000 per mi.	164,000
Pleasant Grove to Provo	9 mi., at 20,000 per mi.	180,000
Provo to Payson	18 mi., at 20,000 per mi.	360,000
West 33rd, South Street	5 mi., at 20,000 per mi.	100,000
Brigham City to Ogden	16 mi., at 20,000 per mi.	320,000
Logan to Smithfield	6 mi., at 20,000 per mi.	120,000
Logan to Wellsville	7 mi., at 20,000 per mi.	140,000
Price to Helper	6 mi., at 11,000 per mi.	66,000
Total		$1,918,000
Counties' amount		959,000
State's amount		959,000

FEDERAL AID PROJECTS

		Est. cost
Proj. No. 2—Ogden-Hooper	9.25 miles	$61,340
Proj. No. 4—Price-Emery	63.00 miles	109,923
Proj. No. 5—Thompson-Moab	35.00 miles	50,686
Proj. No. 6—Moab-La Sal Junction	24 00 miles	34,755
Total		$256,704
State's amount		128,352
Federal aid		128,352
Total amount state	$1,087,352	
Total federal aid	128,352	
Total amount counties	959,000	
Grand total		$2,174,704

Virginia

G. P. Coleman, Commissioner, State Highway Commission, Richmond, writes:

"During the past 18 months, owing to unusual conditions brought about by the war, as well as to the peculiar situation of Virginia in regard to government shipments of materials, we were unable to carry out any of our general plans for highway construction. As a matter of fact, transportation difficulties made even ordinary maintenance in many instances out of the question.

"As far as possible, however, during this period we prepared our plans to resume work as soon as possible after peace, for we have always been imbued with the idea that with the coming of peace, would also come the greatest road era the world has ever known, and with it the development of the untold resources of this country.

TENNESSEE FEDERAL AID PROJECTS

Project No.	State Highway No.	County	Type of Surface	Federal Aid	State Aid	County Aid	Total
1	20	Hamilton	Concrete	$25,937.07	$14,062.93	$14,737.67	$54,737.67
2	7	Hamilton	Macadam	18,454.84	1,545.16	16,909.69	36,909.69
3	7	Franklin	Macadam	40,000.00	53,000.00	28,474.44	121,474.44
4	7	Bedford & Moore	Gravel	49,737.38	24,711.54	25,025.84	99,474.76
5	2	Greene	Macadam	19,160.95	5,839.05	13,321.91	38,321.91
6	2	Washington	Macadam	143,854.82		143,854.82	287,709.64
7	11	Henry	Chert	65,000.00		65,000.00	130,000.00
8	1	Hawkins	Macadam	150,000.00		200,000.00	350,000.00
8	1	Grainger	Macadam	12,500.00	12,500.00	40,000.00	65,000.00
8	1	Sullivan	Macadam	12,500.00	12,500.00		25,000.00
9	3	Carroll	Chert	60,000.00		60,000.00	120,000.00
			Total	$597,145.06	$124,158.68	$607,324.37	$1,328,628.11

TENNESSEE STATE AID PROJECTS

Project No.	State Highway No.	County	Type of Surface	State Aid	Private Subscription	Total
1	7	Coffee	Chert	$28,533.30	$10,000.00	$38,533.30
2	1 & 10	Maury	Chert	25,000.00	6,620.00	31,620.00
3	7	Marion		25,000.00		25,000.00
4	Flag Pond	Unicoi	Macadam	25,000.00		25,000.00
			Total	$103,533.30	$16,620.00	$120,153.30

"We have for the construction of the State Highway System for the coming year approximately $2,000,000, and for maintenance and reconstruction of state highways approximately $750,000. For new construction on county highways, under the State Aid plan, there is approximately $1,000,000. Appropriations for maintenance of county highways have not as yet been made, but will aggregate approximately $1,200,000.

"General plans are well under way for a special 1½ mill tax for construction purposes on the State Highway System. We believe this plan will materialize and make available from all state and federal sources between $4,500,000 and $5,000,000 annually. The advisability of issuing $25,000,000 of bonds is also receiving very careful consideration.

"Virginia is fully alive to the necessity for and the importance of a broad and comprehensive highway policy, and what is very much more to the point, her citizens are back of the program for the immediate development of such a policy."

Washington

George F. Cotterill, Chief Engineer, Olympia, writes:

"I am giving herewith an estimate of the 1919 road program for the State of Washington, covering both construction and maintenance of the state and county highway systems outside the limits of the incorporated cities.

"By reason of the postponed work and funds held over from last year with the new funds available in 1919 it would appear that there will be about $12,000,000 available from Federal Aid, state, county and district funds. The State Legislature has just assembled and in the various plans for the reconstruction period it is certain that all these funds and perhaps some increased resources will be made available for an extensive highway construction program to open as soon as seasonal construction conditions will permit.

Federal Funds: (Post Roads and National Forest Roads)	$825,000
State Funds: (Public Highway, Permanent Hwy., Motor Licenses)	4,175,000
County Funds: 39 Counties: (County Road & Bridge, Road Districts, Special Imp. Districts, County Bonds)	7,000,000
Total	$12,000,000
New Construction program for 1919:	
Federal Administration: National Forest Roads..	$500,000
State Highway Department: Federal Aid Post Roads and State Highways	2,000,000
County Administrations: Permanent Highways and other Main County Highways; District Roads, Bond Roads	5,500,000
Total New Construction for 1919	$8,000,000
Maintenance program for 1919:	
County Administrations (under State Regulation): 2,000 miles of Primary State Highways	$750,000
County Administrations: 1,000 miles County Permanent Highways, etc	250,000
40,000 miles Tributary, Local, District Roads	3,000,000
Total Maintenance for 1919	$4,000,000
Total 1919 Program—Construction and Maintenance.	$12,000,000

West Virginia

A. Dennis Williams, Engineer-Chairman, Charleston, writes:

"Highway construction in 1919 in West Virginia calls for the utilization of sixteen million of funds now available and indications are that three to four million more will be voted this spring in various counties and districts."

Wisconsin

H. J. Knelling, Assistant Engineer, Madison, writes:

"Our plans for 1919 call for about $3,200,000 worth of Federal Aid construction. This is made up of about $1,029,000 for grading only on 238 miles of road, of $1,088,000 for graveling or macadaming 153 miles of road, and $1,095,000 for concreting 52 miles of road.

"In addition to this we have about a similar quantity of money for our so-called State Aid construction in which the Federal Government is not a party. Just how this is divided regarding funds and mileage we are unable to state, but it will run about the same as the Federal work."

Wyoming

Z. E. Sevison, State Highway Engineer, Cheyenne, writes:

"We expect to construct roads costing about $700,000. This is the work which will be undertaken by the State Highway Department and does not include expenditures by the counties which will probably total $500,000 more."

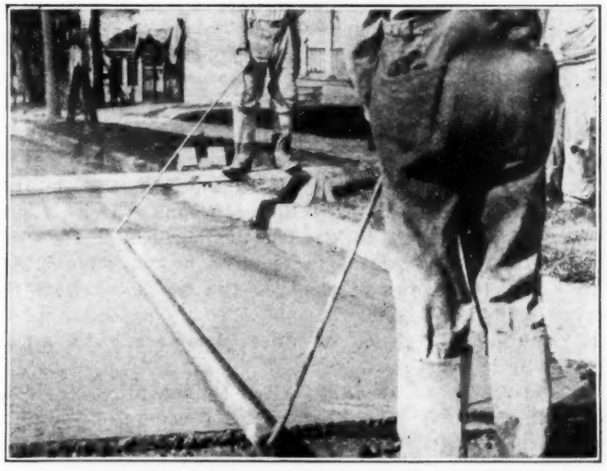
Method Employed in Minneapolis in Constructing Smooth Surfaced Concrete Base for Wood Block Paving

By Ellis R. Dutton, Assistant City Engineer Minneapolis, Minn.

Being convinced by observation and also by theory that the laying of creosoted wood block paving on a smooth top concrete with a bituminous cushion was the best method of construction, we began to lay this class of paving that way in the season of 1918, in the city of Minneapolis.

Difficulty of Getting Smooth Base

The only objection we have had as to this way of laying



OBTAINING SMOOTH CONCRETE BASE FOR WOOD BLOCK PAVEMENT WITH SMALL ROLLER ON TEMPLATES.

blocks was the added cost entailed by reason of getting a smooth top concrete. There was no question as to its possible superiority to the mortar or sand cushion but how to do it was the question. We have had very little trouble from our method of using a sand cushion here in Minneapolis and we have laid over two million square yards since 1902. We are, however, beginning to have some trouble from some of our older pavements on account of the water getting in under the blocks and causing expansion. This difficulty can be attributed more to the method employed in cleaning, using squeegees and power flushing thereby keeping the pavement continuously wet and very wet most of the time. There have been many suggestions made at various times and places as to the best method to pursue and we started in to try out several methods.

Experimental Work

We began experimenting with templates made to the proper crown of the street, having iron stakes attached to hold them to the proper elevation. We used a screed drawn over the templates but on account of the larger aggregates it was

difficult to bring the concrete to the proper grade. We then used a large iron roller about 10 in. in diameter and 6 ft. in length having a long handle and drawn by hand across the screeded concrete. This worked fairly well but would leave marks in the concrete and we then used a belt to obliterate the marks but this was not entirely successful.

Use of Templates and Roller

We obtained the best results by the use of the templates and a small sized roller to smooth the top of the concrete as shown in the accompanying photograph.

The roller was made from a 3 in. wrought iron pipe 13 ft. long filled with sand to increase weight, the handles were fastened to a round block of hard wood about 6 ins. long which

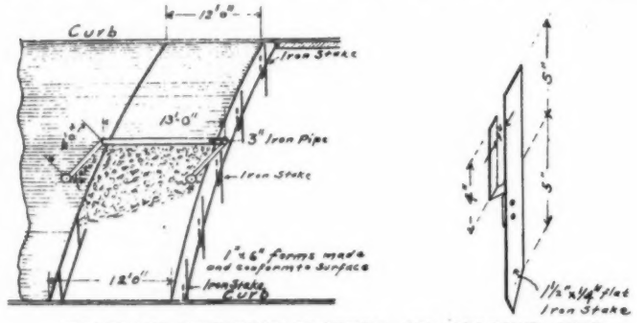


DIAGRAM SHOWING METHOD OF ROLLING CONCRETE BASE FOR WOOD BLOCK PAVEMENT, MINNEAPOLIS, MINN.

was driven into the ends of the pipe. The templates were made from 1x6 in. lumber, four pieces for each complete template, the upper edge being finished to the contour of the street, and requiring at least three templates for working continuously.

These templates were placed 12 ft. apart longitudinally of the street as that was about the limit of the amount of concrete that could be handled by a concrete mixer using a 20 ft. boom. These templates were held to the proper grade by iron stakes with brackets driven into the ground. These stakes were made from 1½x¼ in. flat iron in the form as shown in the drawing. There was also required a removable bridge from which the workman removed the templates from the finished section and from which he filled the space caused by such removal and finished the filled in material with an ordinary long handled float.

By the use of the above described equipment we could do the work almost as rapidly as ordinary concreting and the cost was only a little higher taking into consideration the fact that there was no sand or mortar cushion to be laid.

The Selection of the Value of the Factor "n" in Sewer Design

By Paul E. Green, Member American Soc. C. E., of Marr, Green & Co., Engineers, 17 N. La Salle St., Chicago.

Many articles have been published on the proper value to be assigned to the factor "n" in the Kutter formula, when designing sewers. Quite a few experiments have been described in which "n" has been determined by actual observation. From these discussions certain definite conclusions have been reached and in the case of vitrified tile pipe sewers, it is rather usual to recommend that "n"=.013 to .015. It is the purpose of this article to show that such a definite figure is not justifiable, and that rigidly to follow such a direction is liable to result in defective work.

Definite Value of "n" Not Justifiable

In the average system of sanitary sewers the 8 in. internal diameter pipe will normally compose from 80%to 90% of the total. This size of pipe is likely to be used on a line for several hundred, or in some cases, for two or three thousand feet. Not only is this true, but many lines of parallel sewers will be necessary, particularly if the town layout is on the usual grid-iron plan. The outlet or discharge point of these sewers will generally determine the grade of the main interceptor, which, of course, will be of larger size. Since the topography is rarely ideal, and since usually the main interceptor is the deepest and most expensive line to lay, and must be below the grade of its laterals, it follows that anything that determines the rate of slope of the laterals is a factor of great economic importance. Often some of the laterals, and at times, the trunk must "buck the grade."

Construction Conditions Determine Value of "n"

"N" is a factor of roughness of the wetted surface. For tile pipe it is determined by two things:

1st—The smoothness of the materials, and,

2nd—The care with which joints are made.

Of these, the second is the larger factor.

Probably the most complete summary of the value of "n" will be found in Vol. 1 of Metcalf & Eddy's work on American Sewerage Practice. In this work the authors recommend, "under reasonably good operating conditions" a value of "n"=.015 for vitrified pipe sewers. The writer agrees with them. "Under reasonably good operating conditions" n=.015 is nearly ideal, but the trouble is that the operating conditions do not determine the value of "n". It is largely determined by the construction conditions.

We will assume a minimum velocity of 2.5 ft. per second and an 8 in. pipe, then:

1. for "n"=.011, the slope in feet per thousand is 3.9
2. for "n"=.013, the slope in feet per thousand is 6.3
3. for "n"=.015, the slope in feet per thousand is 9.0

Relation Between Value of "n" and Depth of Sewer Cut

The difference between the first and third of these figures is over 5 ft. per thousand and means that an 8 in. vitrified pipe sewer will be 5 ft. deeper at the end of a 1,000 ft. run if laid on the third grade than on the first, and 19 ft. deeper at the end of 2,000 ft. The difference in value between the second and third "n" in 2,000 ft. means 5.4 ft. in depth of cut. It should be remembered that in deep sewers, we "pay through the nose" for each foot of additional depth, particularly in bad soil.

Flat Grades

It is well known that there is no difficulty in securing, by means of careful workmanship, a value of "n"=.011 in vitrified pipe sewers. Williams & Hazen in their Hydraulic Tables, page 52, use a value of "C"=110, giving a velocity of 2.5 ft. for 8 in. pipe with a slope of 4.39 ft. per 1,000, which corresponds to a value of less than .012. Chas. P. Chase, M. Am. Soc. of C. E., Consulting Engineer, informed the writer that over 20 years ago he designed and supervised the construction of a system of sewers for the City of Mendota, Illinois, in which his ruling grade for nearly the entire work on 8 in. sewers was 2.5 ft. per thousand. He examined this system a few years ago, and found the surfaces clean, no deposits, and no complaints of trouble. Messrs. Hill & Ferguson, Consulting Engineers, New York City, designed a system of sewers for the U. S. Housing Corporation's development at Paradise Creek, Va., during the summer of 1918, in which the grades were 2.5 ft. per 1,000 for 8 in. sewers.

Grade Reduction to Save Deep Cutting

The writer has done the same thing for the past ten years, and has had no trouble. Engineers of experience are continually doing it, and yet our technical literature almost universally recommends that "n" shall be not less than .013, and preferrably .015. The Engineering Staff of the U. S. Housing Corporation, of which the writer had the honor to be a member, in its instructions to its designing engineers, recommended "n"=.013, but when the designs came in after following these instructions and showed in many cases heavy cuts, we promptly reduced the grade in order to cheapen the cost and improve operation.

Conclusions

It would seem from the above, that engineers are preaching one thing, and practicing another. The average designer is frequently liable to be more conservative in his writings than in his work. But in view of the above, the writer is willing to go on record, as follows:

1st—That with good average workmanship tile pipe sewers may be safely assumed to develop an "n" not greater than .012.

2nd—That in any bad, wet soil, we are much more likely to get "n"=.011 at the bottom of a 10 ft. cut than we are "n"=.015 at the bottom of a 20 ft. cut. This is because of the much greater difficulty of getting good work in the second case than in the first.

3rd—That the saving attained because of less depth required will pay for the more careful workmanship required many times over.

4th—That few experienced engineers permit the value of "n" to bother them at critical times, but design and construct on a rational basis, which takes into consideration the character of the soil and the depth of the sewer.

The Brick Highways of Ashtabula County, Ohio

By Ray N. Case, County Engineer, Ashtabula County, Jefferson, Ohio

When I took charge of the highway department of Ashtabula County, in the fall of 1913, there were 40.4 miles of improved road out of a total of 1,256 miles of highway in the county, approximately 3 per cent being improved. Of this mileage 1.52 miles was of brick, 2.61 miles of one course concrete and 36.27 miles of tar and water bound macadam.

Few Roads Built Prior to 1913

The brick road above mentioned was constructed in 1908 using a fire clay brick upon a natural sand base, with sand filler. This section of road is on the Main Market Road No. 1 of the State Highway System, and aside from settlements, due largely to seepage from street car track which traverses the entire length of the highway, the road is in very good condition at the present time.

The concrete roads were constructed 16 ft. in width, while the macadam roads were 9 and 16 ft. in width, the greatest mileage however being only 9 ft. in width,

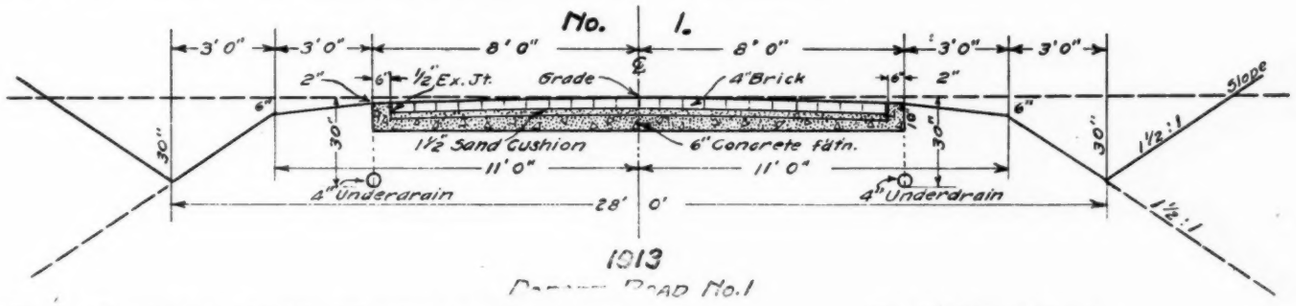
County System of Highways

In the winter of 1913-14, a county system of highways was decided upon by the County Commissioners, covering the main travelled roads of the county. It was their desire to follow largely the Inter-County Highway routes, but as Inter-county funds, or State co-operation, could not always be obtained, the greater number of our highways were constructed witthout state aid, and sometimes deviated from the Inter-county routes.

As the macadam roads previously constructed were narrow they rutted easily, so it was decided that if we were to construct a narrow road, it must be of such material as would withstand abrasion, and concentrated traffic and at the same time be economical in design and construction.

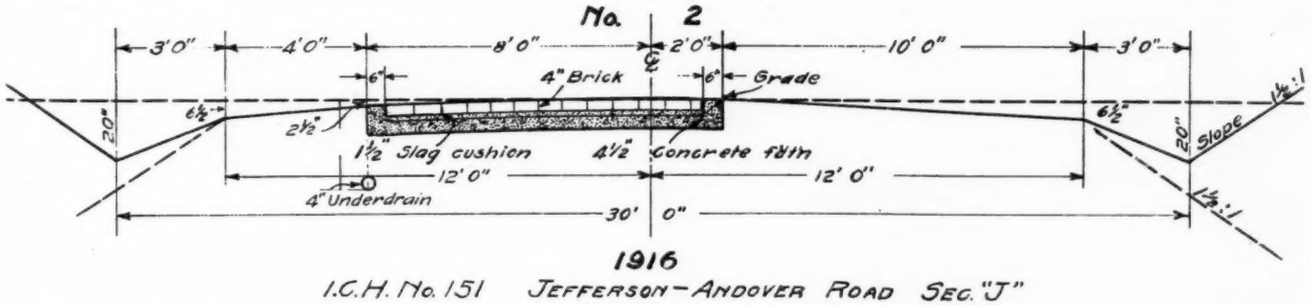
The Dorset Brick Road a Model

The first brick highway constructed under my charge was known as the Dorset Road. This highway is 3.25 miles in length, the brick wearing surface being 15 ft. in width, with two 6 in. curbs constructed integral with the base and flush with the brick surface. The base was a 1-3-6 mixture, using crushed furnace slag as the coarse aggregate. The thickness of the base was 4 ins. at the sides and 6 ins. in the center with a flat sub-base. (See Cross Section No. 1.) Before laying the brick a 1½ in. sand cushion was spread over the base and compacted by hand rolling. This highway was constructed upon a clay subsoil that was practically impassable to traffic during the spring and fall months. After four years of heavy traffic, very few defects have occurred. Some longitudinal cracks have developed, but to date no maintenance of the surface has been required. This road was the first of its kind in this section of the state, and is considered by many a model road in every particular.

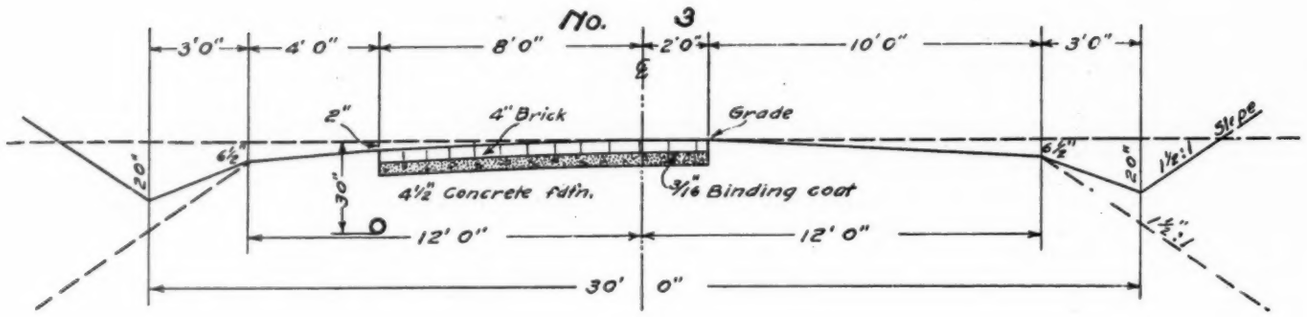


The 10 Ft. Brick Road

In 1915, the first 10 ft. brick roads were constructed. In this year 25 miles were placed under contract. These roads were designed 10 ft. in width, 9 ft. of brick with flush curbs 6 ins. in width and upon a 4½ in. gravel concrete foundation, using 1½ in. sand cushionwith crown of ¼ in. to the foot. (See Cross Section No. 2.) This type of road constitutes our greatest mileage, and while some criticise the narrow road, it nevertheless is the highway for the rural districts.



The 10 ft. dirt side road gives the horse drawn traffic a desirable road in summer, and in winter, by reason of better drainage is made passable for any kind of travel. With the brick section placed at one side of the road, less maintenance of the shoulders is required than would be the case, were the improved section placed in the center of the travelled roadway.



1916

WAYNE ROAD No. 1

Narrow Pavement on One Side of Roadway

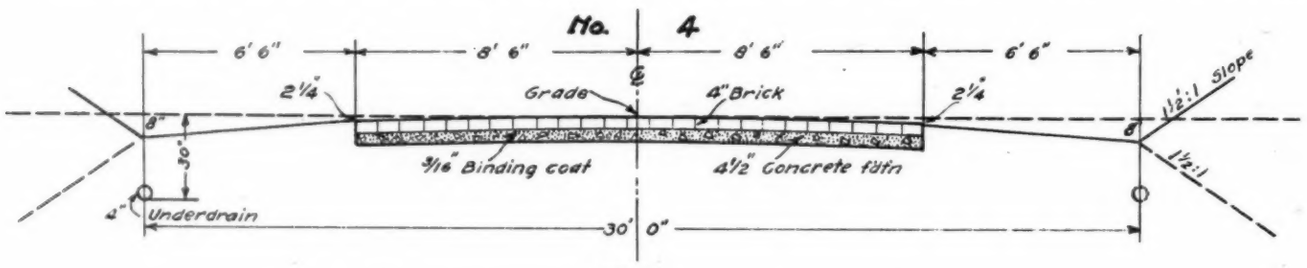
Ashtabula County is largely a dairying community and the ability to use the highway at all times of the year is a great help to the farmer. A 16 ft. highway on main roads where there is a heavy automobile traffic, would be more desirable, but in the outlying townships a narrow road, built on the right side of the road leading toward the towns or railway depots provides a fine highway at a much less cost than would be the case if wider roads were constructed.

Slag Bed Desirable to Give Stability

I believe that slag used as a cushion, or bed, is much more desirable than sand, for the slag as soon as compacted, was found to be a protection against settlement which occurs in pavements where sand is used as a cushion. It was from the use of slag as a cushion that the monolithic type of pavement we are now constructing, partly had its inception. Engineers, in the past, recommended the use of the sand cushion to give resiliency to the pavement. The use of the slag cushion destroys any resiliency that the sand had supplied; hence, that factor, or weakness, in the construction of a brick pavement was eliminated. Any tendency to give, or change in shape or form of a brick road results in failure, and the more rigid and unyielding we can construct a pavement the longer it will resist abrasion and impact.

Slag Bed Supercedes Sand

A very striking illustration came under my observation, relative to the use of slag as a cushion, or bed. On one road, construction was started late in the season of 1916 and while the concrete base was completed, we were unable to grout about 1,000 ft. of the brick pavement which had been laid and rolled upon the previously constructed slag cushion. Owing to the fact that traffic could not be detoured around this section, we permitted travel over the ungrouted portion of the road. The next spring we found the road showed very little settlement at any point. The loose brick were removed and the slag cushion was found to be practically united with the concrete base. As no settlements had occurred, the brick showed little evidence of wear, and after cleaning, were relaid and grouted without being rolled, which is required where sand is used for a cushion.

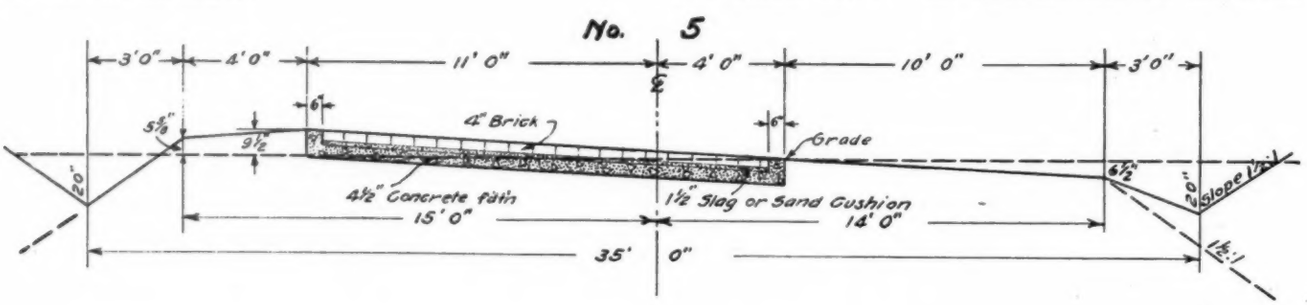


1916

MAIN MARKET No. 1 GENEVA WEST SECTION

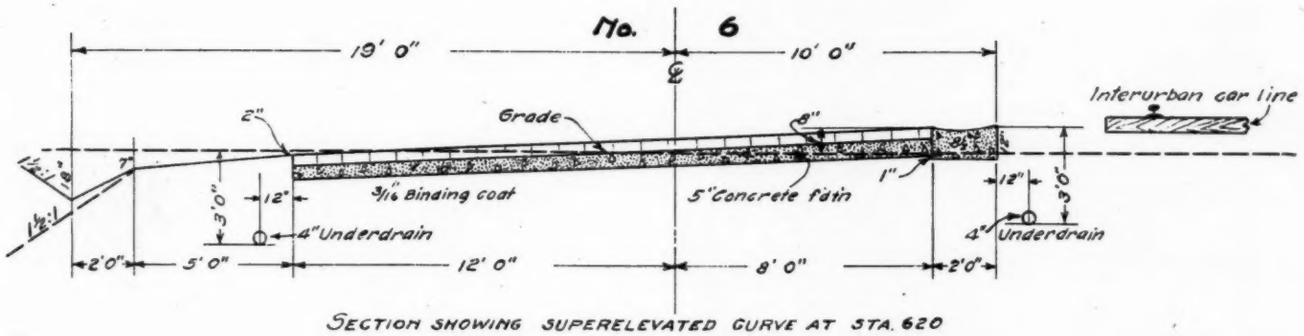
The Monolithic Type

When we found that the sand cushion was not absolutely necessary in the construction of a brick road, the monolithic type was decided upon, and in 1916, the first roads of this type were constructed. One road 2.95 miles in length and 10 ft. in width was constructed in Wayne Township (See Cross Section No. 3) and 2.05 miles, 17 ft. wide in Geneva Township. (See Cross Section No. 4.) The aggregate used was gravel con-



1916

SECTION SHOWING GENERAL METHOD USED IN SUPERELEVATING CURVES ON I.C.H. No. 151 JEFFERSON-ANDOVER ROAD SEC. "J" CURVE WIDENED 5 FEET

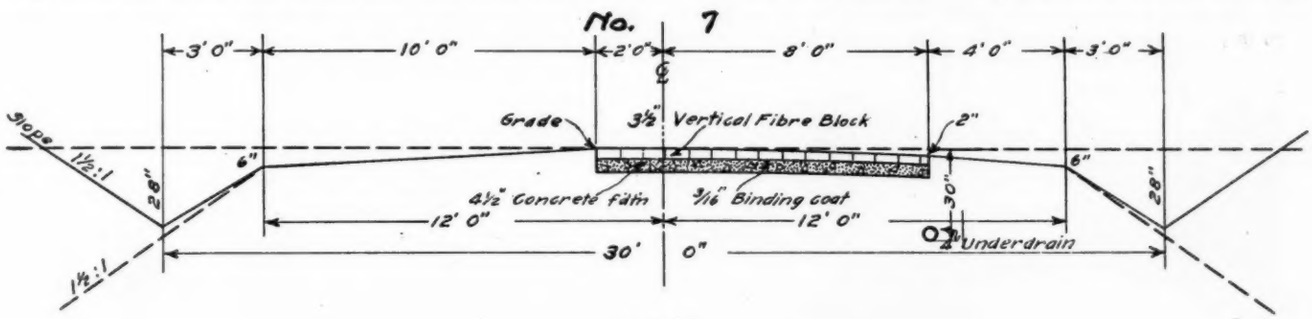


SECTION SHOWING SUPERELEVATED CURVE AT STA. 620
MAIN MARKET No. 1. CLEVELAND-BUFFALO ROAD
CURVE WIDENED 4 FEET

glomerate graded in size from 1½ ins. down to sand with approximately 40 per cent passing through a ¼ in. opening or square mesh. Three hundred and fifty sq. yds. was the daily average, and as great care was taken a smooth road was the result.

A Parrish templet was used to cut the concrete base and a binder coat of 3-16 in. sand-cement of a ½ mixture was spread over the concrete base before the brick were laid. (I consider the ½ mixture of sand-cement rather strong, and on later roads have used a 1/3 and ¼ mixture with equally good results.) The brick were well inspected. This should be done as they are being placed upon the gravity conveyor, also after being laid in the sand-cement bed. The brick were rolled away. Very few longitudinal cracks have appeared, although transverse cracks have appeared at intervals of 30 to 35 ft.

About 3 sq. yds. of this pavement have been replaced. The failure occurred on the inside of a 3-degree curve. The brick appeared to crumble, indicating expansion at this point. In repairing the pavement, we removed the loose brick, roughened the base, applied neat cement, relaid and grouted the brick in the usual manner. No transverse or expansion joints are used in our pavements, as I do not believe in their use. A thin cross-joint might be advisable at the intersection of vertical curves, when the grades are heavy, or at points of tangency on curves. Super-elevation of curves is a distinct advantage in the construction of highways, the amount of elevation, in my judgment, being dependent upon the degree of horizontal curvature, with due allowanc for vertical curvature. We widen all curves over 3 degrees. This extra width varies from 3 to 10 ft. (See cross-sections Nos. 5 and 6.)



1918
CHERRY VALLEY – DORSET ROAD

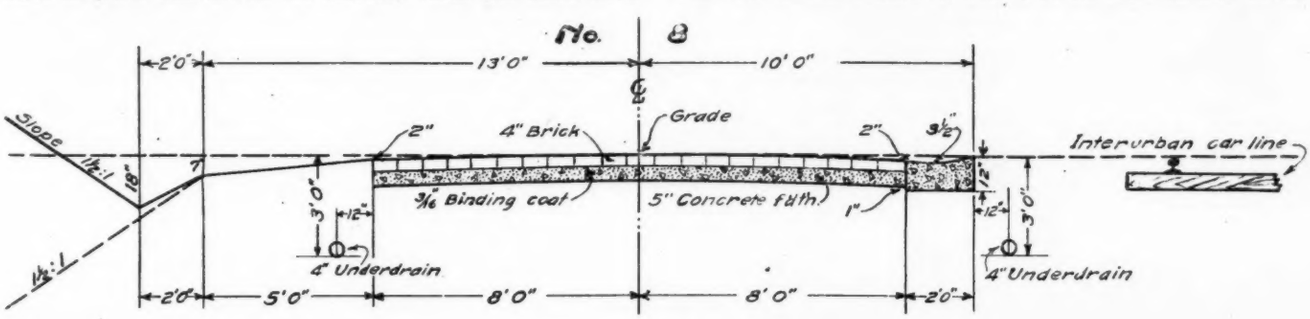
by hand with a cylindrical roller 24 ins. in diameter and 36 ins. long, filled with sand.

This road shows no transverse or longitudinal cracks, and only one settlement, due to a washout from under the entire slab, yet in this condition supported the heavy traffic for three months with a settlement of less than 1 in. in a span of 6 ft.

The 17-ft. road constructed the same year is wavy and rough, due largely to the fact that no templet was used in cutting the base. The templet provided for this work was not satisfactory, and the base was luted by hand. The road is now much smoother than when constructed, as too heavy a layer of grout was left on the surface, which has since worn

40 Miles of Brick Highway Constructed in County Since 1916.

Since 1916, we have constructed approximately 40 miles of brick highway. Of this total 15 miles have been of the monolithic type using a 4-in. wire-cut-lug brick upon a 4½-in. gravel concrete base, with 3/16 in. sand cement binder coat. One road 3.6 miles in length is constructed with vertical fiber brick 3½ ins. in thickness, with 3/16 in. sand cement binder



MAIN MARKET No. 1 CLEVELAND-BUFFALO ROAD

TABLE I—DATA ON BRICK ROADS IN ASHTABULA COUNTY, OHIO

Name of Road	Miles	Sq. Yds.	Feet Wide	Total Cost	Year Built	Contractor
Dorset Road	3.27	28,555	15	$56,272	1914	T. P. Fitzgerald
Morgan No. 4	3.36	17,795	10	44,925	1915	T. P. Fitzgerald.
Hampden-Andover	2.81	14,845	10	32,702	1915	T. P. Fitzgerald
Trumbull-Geneva	8.50	146,958	10-16	116,060	1915-16	B. F. Hewitt
M. M. No. 1 Geneva-Ashtabula	6.50	61,384	16	143,000	1916	Hart & Kemp
I. C. H. No. 2 Geneva-West	2.05	23,000	17-30	48,000	1916	T. P. Fitzgerald
Dorset-Denmark	.89	7,847	15	16,106	1916	T. P. Fitzgerald
Andover-North	2.05	10,775	10	23,474	1916	Linninger & Bennett
Andover-North Extension	.50	5,150	16-24	11,500	1916	Linninger & Bennett
Eagleville No. 2	.80	4,694	10	10,600	1916	T. P. Fitzgerald
Trumbull-Morgan	2.67	14,130	10	33,819	1916-17	Linninger & Bennett
Williamsfield Road	2.10	10,717	10	23,468	1916-17	B. F. Hewitt
Wayne Road	2.95	15,487	10	36,472	1917	Wade & Nims.
Morgan No. 4	.25	1,408	10	4,731	1917	C. W. Harrington & Son
I. C. H. 151 Jeff.-Andover	6.30	34,278	10	86,400	1916-17-18	Glenn Hadley
Cherry Valley-Dorset No. 1	3.63	23,500	10	63,890	1917-18	T. P. Fitzgerald
Kingsville-Sheffield	5.35	39,300	10-16	120,632	1917-18	T. P. Fitzgerald
Jefferson-Eagleville	3.46	23,258	10-16	66,257	1918	Hart & Kemp
Jefferson Village Extension	.60	5,209	10-16	12,000	1917	Glenn Hadley
Ashtabula-Plymouth	4.60	29,525	10-30	112,000	1918	T. P. Fitzgerald
Totals	62.64	411,815		$1,062,308		

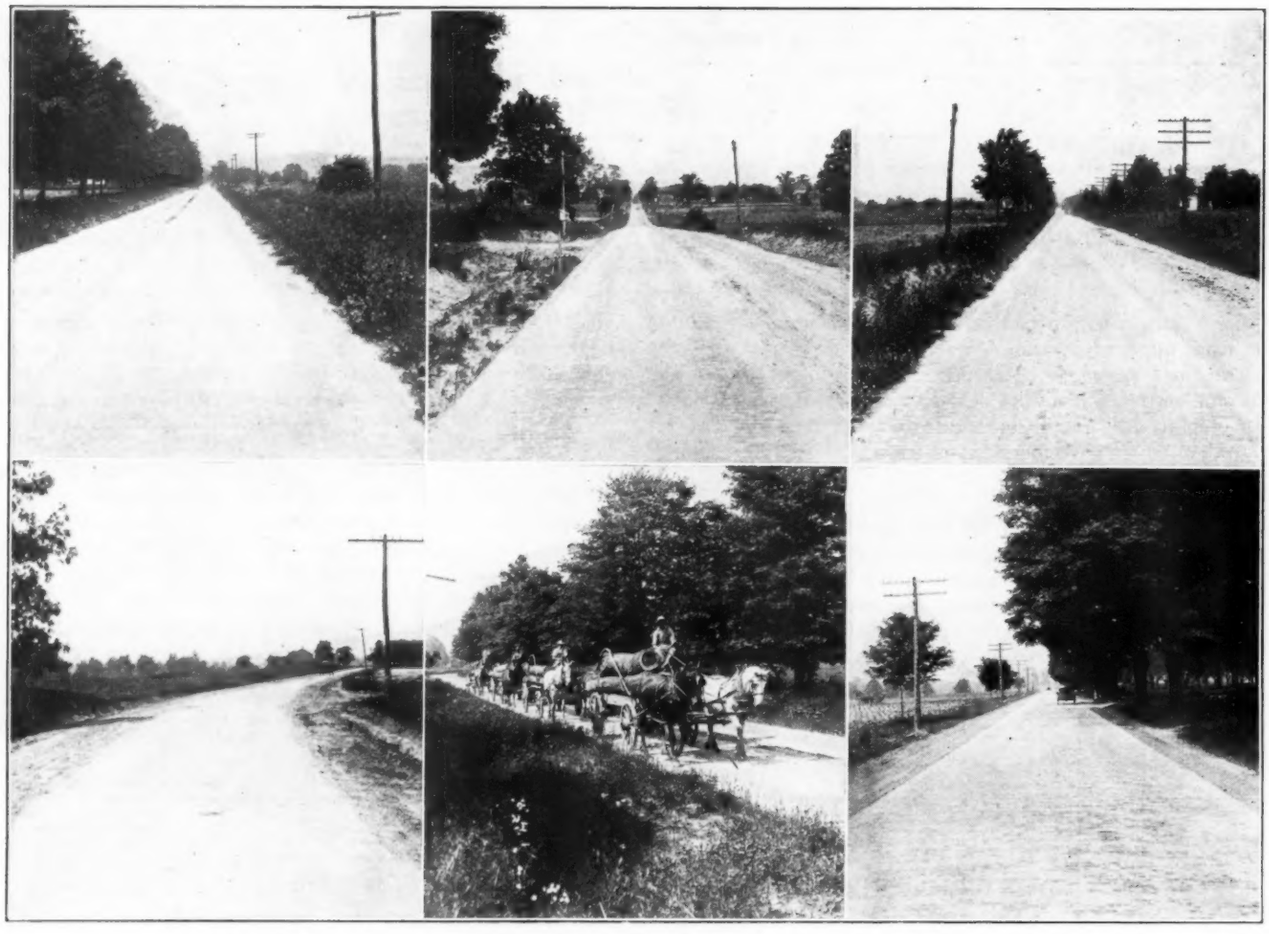
coat. (See cross-section No. 7.) However, as this road has only been down a year, little can be said for or against it.

62 Miles Since 1913

Since 1913, we have constructed 62 miles of brick road in the county, 15 miles of which were of the monolithic type, previously described. Plans are prepared for 40 miles additional (all monolithic) which includes a 12-mile section of the main market route of the state. This highway (see cross-section No. 8) is designed 16 ft. in width, with a 4-in. wire-cut-lug brick upon a 5-in. gravel concrete base. A concrete gutter curb is placed along the street car side of this highway which provides 2 ft. additional width of pavement and at the same time provides better drainage to the highway. This highway is at the present time being advertised for 1919 construction.

Essentials in Design of Roads

In the design of a brick road, or in fact any other type of highway, at least three essentials must be kept in mind: First of all, proper drainage; without it, no pavement can last. Underdrainage is necessary, regardless of the kind of subsoil. Second, durability; build the best, as it is always cheapest in the end. Avoid heavy maintenance cost. Third, adaptability. A study of conditions should be made, traffic census



REPRESENTATIVE VIEWS ON THE BRICK HIGHWAYS OF ASHTABULA COUNTY, OHIO.

Top Row, Left to Right: Geneva Trumbull Road—Wayne Road—Geneva Trumbull Road. Bottom Row: Jefferson and Dorset Road —Andover No. 1 North Road—Geneva Road, West Section.

VIEWS ON BRICK HIGHWAYS OF ASHTABULA COUNTY, OHIO.
End Views on Geneva-Ashtabula Road—Center View on Wayne Road.

taken, and the type of highway selected that will best care for the most severe use. No matter how unimportant a road may be before it is improved, it at once becomes a main highway when improved.

Features of Present-Day Water Purification Practice

A Non-Technical Review Written for Municipal Officials.

By Milton F. Stein, Civil Engineer, Chicago, Ill.

Although the purification of water for public supply has been on a well-established basis for several decades and of late years purification plants have been built in ever increasing numbers, the writer not infrequently meets municipal officials, health officers and others interested in the public well-being, who are not familiar with the basic principles underlying this art, its scope and limitations, and its relative position in the civic organism.

This is not so surprising as may at first appear, for while the periodical literature relating to the subject is voluminous most of the papers published have been of a technical nature, or else descriptions of specific purification plants, in which special design features and details have been emphasized, rather than the fundamentals of the process and the functions of the various appliances essential thereto. Furthermore, during the development of this art, and of other phases of sanitary engineering, and the acquisition of a better knowledge of the interrelation existing between these phases and of the significance of the various factors involved, there has been not only an improvement of the methods and devices used, but also a readjustment, from time to time, of viewpoint as to the purpose and accomplishments of water purification. For these reasons, and because the revival of activities in municipal construction during the coming year should add interest to this subject, it would seem permissible and perhaps not unprofitable to discuss its present status, and to touch upon certain closely allied questions.

What is Meant by "Water Purification"

There is often confusion of mind among those not well versed in the matter regarding what "impurities" in the water it is desirable to remove, which is probably engendered by the promiscuous reading of literature on the treatment of industrial and boiler waters as well as of municipal supplies. The impurities in drinking water in order of their importance are:

1. Bacteria and other forms of microscopic plant and animal life which may cause disease or by their presence enhance the possibilities of disease.

2. Sewage pollution, which with the dual use of our water courses for both drainage and water supply, is almost inevitably present, although usually in great dilution, and the removal of which is desirable for aesthetic reasons.

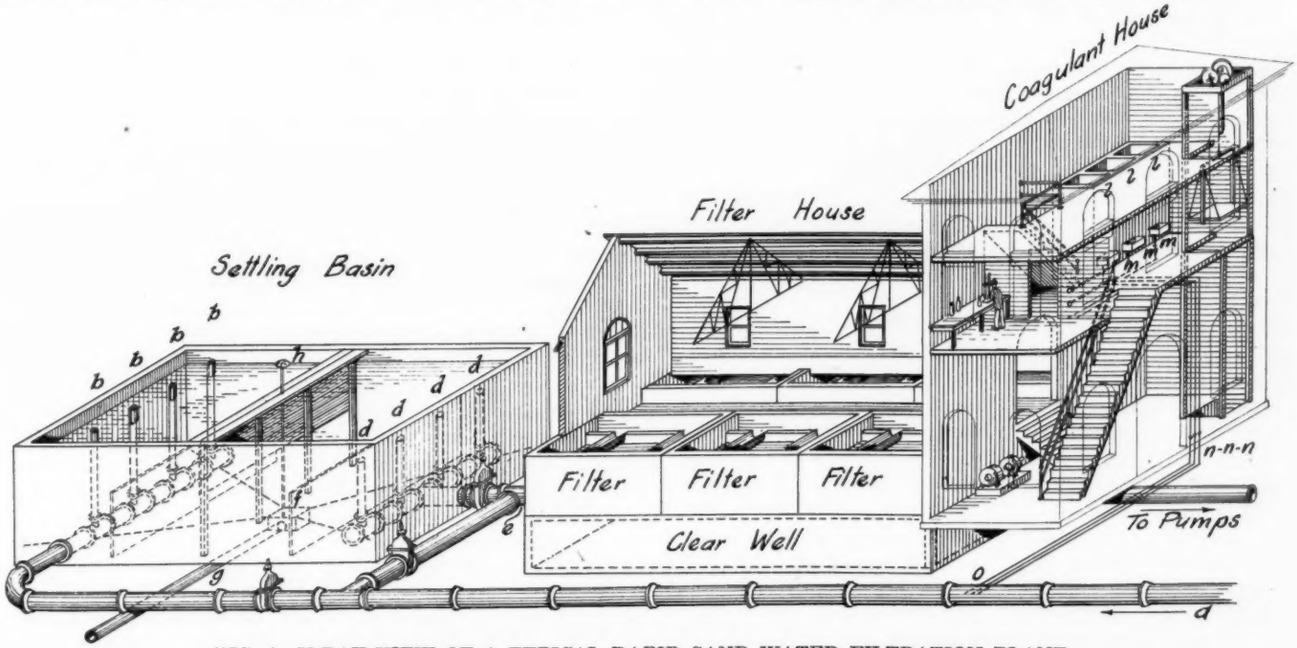


FIG. 1—X-RAY VIEW OF A TYPICAL RAPID SAND WATER FILTRATION PLANT.

3. Turbidity, caused by soil-wash, clay or silt, not necessarily harmful, but unpleasantly suggestive.

4. In specific cases, where waters contain large quantities of salts of calcium and magnesium, or carbonic acid, causing the combination of objectionable qualities called "hardness," or where iron or manganese are present, these may be termed impurities. With these exceptions the mineral salts naturally present are desirable, and the experienced water expert does not attempt to improve on nature's handiwork by their elimination.

Methods of Water Purification

The confusion of mind mentioned previously extends also to the methods of purification, partly because of the use of several designations for the same method, and partly because of the obsolete processes described in the older literature and a few of which are artificially sustained at the present time, although far past their natural span of life. The two processes of most importance in the development of water purification were, "natural," "slow sand" or the "English" system of filtration, and the "mechanical," "American," or "rapid sand" system, both making use of filtration through beds of sand.* The slow sand system was used in quite a number of the older and larger plants in this country, and enjoyed an even greater vogue in Europe. The rapid sand system, while a later development, has so far outstripped its rival that it may be said, without fear of contradiction, that for municipal supplies this is the only process, with slight modifications to meet special conditions, which need be considered. Plain sedimentation, coagulation and settling, and other methods have had their advocates in the past, but thorough trial has found them wanting, and they have been largely replaced or supplemented by the rapid sand filter.

Rapid Sand Filtration

Figure 1 shows a typical rapid sand filtration plant. The raw water is pumped from the river to the settling basin thru the main *a*. As it passes the point *o*, en route, a coagulant solution is added. This is generally a solution of aluminum sulphate, although sometimes iron sulphate is used. This coagulant, combining with the natural salts in the water, forms a flocculent precipitate, which greatly assists in the settling out of silt and suspended impurities, and also forms a jelly-like film over the surface of the filter sand, which is of a very fine, porous, sponge-like structure, allowing water to pass through readily, but retaining even the most minute solid matter, such as bacteria, etc. The use of a coagulant is of fundamental importance, as without it very little of the fine suspended matter and bacteria would be removed in the settling basin and the filters would act merely as coarse strainers, rendering the whole process very inefficient. While the theory of coagulation seems very simple, it is profoundly affected by the condition of the raw water, temperature, reaction period, so that it really is a very interesting example of colloidal chemistry.† Before designing any plant, a thorough examination of the coagulating qualities of the water should be made, so that the parts of the plant affected thereby may be properly proportioned, as this has much to do with the success of the plant. The use of a coagulant is harmless, as it all enters into the flocculent precipitate, which is insoluble, and either settles out in the basin or is retained upon the filters.

The water enters the settling basin through the risers *b-b-b-b*. In the settling basin the chemical reaction between the coagulant solution and the alkaline salts in the water is carried to completion, and the resulting precipitate settles out, carrying with it a large proportion of the bacteria and silt originally present in the water. Periodically the accumulated precipitate is flushed out through the valve *f* operated by the hand wheel *h*. The settled water enters the pipes *d-d-d-d*, and flows to the filters.

Referring now to Figure 2, which shows a cross-section of the same filter plant, the settled water enters thru the conduit *e*, from which there are branches *p-p* to each filter unit. Entering the filter, the water passes downward through a layer of sand, usually 30 to 36 ins. deep, on the surface of which, and forming the true filtering medium, is the mat of coagulum already mentioned. Then flowing through a substratum of gravel it enters a manifold of perforated collector pipes, which carry it to a common header leading to the filtered water basin, from whence it is pumped to the consumer.

Each filter is equipped with a rate controller, which automatically maintains a constant rate of filtration, a very essential element in the success of the process.

Naturally there is an increasing accumulation of impuri-

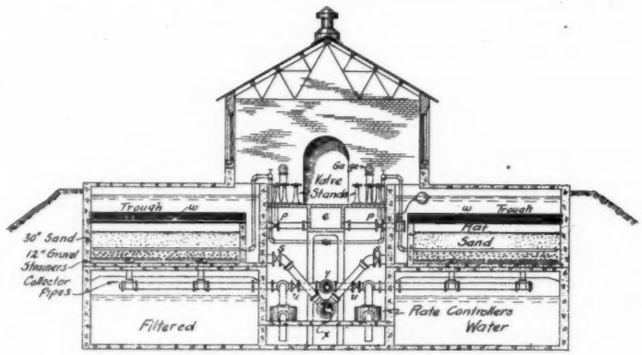


FIG. 2—CROSS SECTION OF A RAPID SAND WATER FILTER PLANT.

ties on and in the filter, which must be removed periodically, as a rule daily. This is accomplished by washing the filter. To do this, the inlet and outlet valves are first closed; then the sewer valves *s-s* are opened, and lastly the wash water valves *u-u*. This admits filtered water from the pipe *v*, which may be connected either to the city mains or preferably to a special elevated tank, to enter the collecting manifold and stream upward through the sand, raising this bodily and thoroughly washing it. The wash water and contained impurities escapes into troughs *w-w*, which carry it into the sewer *x*. After about five minutes washing the sand will be perfectly clean, and the filter is again put into commission.

Attention may be called to the coagulant house in Figure 1. Here are shown the solution tanks *l-l-l*, the orifice boxes, *m-m-m*, which measure out the solutions at a uniform rate, the coagulant pipes *n-n-n*, the elevator for handling chemicals, and the laboratory.

These are the essential features of a rapid sand filter plant. In large plants, there are necessarily many additional devices and complications.

What Filtration Will Accomplish

If this article were written only for those fairly familiar with filtration this section could be omitted, but for the benefit of the uninitiated, it seems well to discuss briefly the results which are obtained by filtration. In the first place, the process above described will remove all suspended matter from a water, even the most minute. It will even go somewhat further, in that it will remove at least part of substances in a condition of false or colloidal solution, such as the coloring matter which gives to some waters a yellow or brownish tinge. Of the suspended matter thus removed, the bacteria present in the water form a part, which while often only small in comparison to the whole, is yet the most important, since the removal of the bacteria renders the water

*For descriptions of the various processes and the theory of filtration, see the author's book, "Water Purification Plants and Their Operation," John Wiley & Sons, N. Y., Publishers.

†"Colloids in Water and Sewage Purification," by M. F. Stein, Engineering Record, June 24, 1914.

perfectly safe and free from all possibility of causing disease.

Of the bacteria found in water many varieties are harmless, but there are a few which if ingested with food or drink, will cause grave diseases. One of the most formidable of these is typhoid fever, which is in part a water-borne disease. In recent years much preventive work as regards typhoid fever has been done, such as the elimination and screening out of flies, the cleaning up of contaminating material, the disinfection of patients' stools, the introduction of quarantine, etc. However, these measures do not guard against the infection of water supplies by typhoid carriers—those apparently healthy persons in whose intestines millions of typhoid bacteria are continually breeding and being constantly eliminated with the discharges of the bowels and the urine. The author has proved to his own satisfaction that typhoid carriers alone can easily cause all the typhoid fever usually found in communities using unfiltered water.

Typhoid fever statistics taken for a considerable period before, and after the use of filtered water, and previous to the introduction of the additional preventive measures above

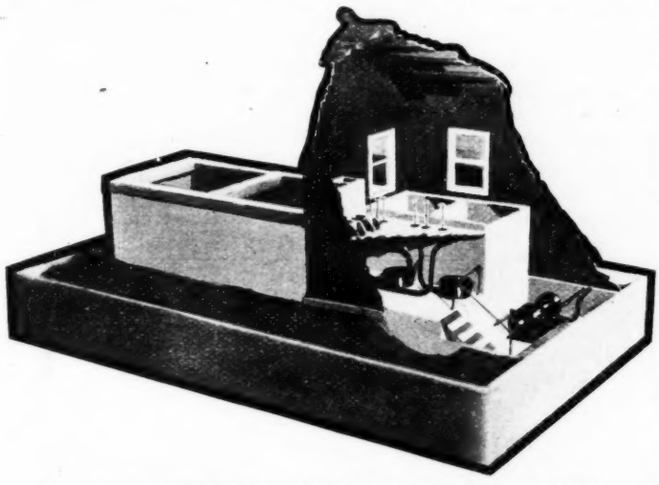


FIG. 3—SIMPLIFIED TYPE OF FILTRATION PLANT SUITABLE FOR TOWNS OF 5,000 AND LESS.

mentioned have as a rule shown such a marked reduction after filtration that there can be no doubt that this measure has by far the greatest weight in combating this disease, although by supplementary means the so-called residual typhoid can be largely eliminated.

Other intestinal disturbances, particularly those affecting children are largely done away with.

Like all works of mankind, filtration is not quite perfect. Occasionally a microbe or other bit of solid matter gets by. This is partly inherent to the process, and partly due to faults in operation. This has led to special studies of the process as a whole, in two directions; one to answer the question of how contaminated a water may be and still be capable of purification by filtration; the other of how to devise a finishing process which would put a quietus on any germ that might find its way through the filter. The answer to the first question is that there undoubtedly is a degree of contamination at which filtration becomes ineffective, but this is far beyond that point of pollution of a water supply where it ceases to be conceivable for human use. The second question has been answered of recent years by the installation of a chlorination apparatus in most filtration plants, by means of which a minute amount of chlorine gas is fed into the filtered water, which small as it is, is still capable, in the absence of other polluting matter to absorb it, of destroying the possible recalcitrant germ previously mentioned.

So that it may be safely said that filtration is capable of producing a perfectly clear and harmless drinking water under all conditions.

Water Softening and Iron Removal

By suitable modifications the rapid sand filter plant can be adapted for softening a hard water or removing iron from well supplies in addition to performing its usual functions. It is necessary to insert a note of warning here, however. Every such case must be carefully studied in conjunction with suitable experiments and the design should be entrusted only to an engineer with special experience in this phase of the work. Furthermore it must be remembered that the additional complications involved add considerably to the first cost as well as to the cost and difficulties of operation.

Water Sterilization

With the introduction of liquid chlorine as a sterilizing agent for water, sterilization has become very popular and has even been championed as a substitute for filtration. Certainly the compact and very practically designed apparatus now on the market, together with the fact that its first cost is almost negligible as compared to that of a filtration plant, must incline anyone in search of a water purification process toward it. However, it does not actually purify the water, but simply kills the bacteria. Moreover, other suspended matter absorbs chlorine as well as do the bacteria and in proportion to the amount present, so that with any appreciable turbidity, more chlorine must be added in order to be effective, which causes objectionable tastes. This limits the application of this process as a sole means of purification to comparatively clear waters. There is still another aspect to the question. If a community has once become accustomed to the use of bacteria-free water, a temporary return to the impure water to which it was formerly accustomed will cause a very extensive outbreak of intestinal trouble. So that if through carelessness, the continuous introduction of chlorine ceases or is not properly administered such an outbreak is very likely to occur. With a filtration plant, the several steps in the process and the necessity for frequent attention make a complete breakdown almost impossible, so that this danger is non-existent, while with liquid chlorine a cessation of treatment may occur thru the inadvertent turning of a valve, or failure to replace an empty tank. We must concede, however, that liquid chlorine is indispensable for emergency supplies or for use until a filtration plant can be built, and is very desirable as a finishing process even with filtration.

Design and Engineering Important

The large number of descriptions of filtration plants now extant have made it very easy for inexperienced engineers to enter this field and "design" plants, which are in fact nothing more than replicas of the ones described in engineering journals. Now, although the process of filtration seems quite simple, the details of the various steps are really quite intricate and subtle, and can be mastered only by extensive experience coupled with keen observation. In this respect the art of filtration somewhat resembles the late-lamented art of brewing, where an intimate knowledge of detail, based on long experience and on tradition handed down from master-brewer to apprentice, was a prerequisite to success. These replicas, while outwardly presenting a satisfactory appearance, are usually defective in the many small details which go to make a successful plant, and are a continual aggravation to the operator. Some interesting tales might be told of the same gross defect in design, found successively in a number of plants (and corrected at a cost of thousands of dollars in each case) which was ultimately traced to a draftsman's error in the plans of a plant much heralded in the engineering journals. There are also many plants of smaller size which, to the practiced eye, are obviously simply scaled down from some plant of larger size, and in which the elaborations of construction and complications of apparatus of the large plant have been needlessly retained, with a resultant higher first cost and an entirely unnecessary burden on the operation.

In every filtration project the conditions should be carefully studied with a scrutiny which will overlook no small but important detail, yet at the same time with a broadness of vision which can properly gage future requirements and apply to them the results of past experience. In the design many details can be incorporated which will make the finished plant better, or render the construction simpler for the contractor, or improve the operation. By proper supervision of construction, the leaky tanks, crumbling concrete and decrepit apparatus not at all uncommon in filtration plants of a few years' standing can be avoided. Certainly, in view of the long and continuous service expected of a filtration plant it is poor economy indeed to skimp on the engineering or to entrust it to incompetent engineers.

Operating Conditions and Their Control

With anything like proper care, the filtration plant is well safeguarded against a complete failure of the purification process. The arrangement in successive steps aids in this, since a falling off in the efficiency of one part of the process merely throws an additional burden on the other parts. Then again, the improvements accomplished at each step can be easily noted, the sufficiency of coagulation is determined by observation, or by simple chemical tests, and the condition of the end product is apparent to the eye, which can detect a very slight turbidity. This does not mean that the quality of the effluent can be judged by the absence of turbidity, but where the raw water is fairly turbid there is a correlation between clarity of effluent and removal of bacteria which to a large extent served to establish confidence in the process prior to the general introduction of bacteriological tests, and which if the truth be told, is still largely relied upon in many of the smaller plants. The author's experience with bacteriological tests in the hands of the small plant operator has not been encouraging. It is not to be expected that a non-technical man, who, likely as not, was pumping station engineer before the filtration plant was built, should appreciate the niceties of bacteriological technique necessary to secure reliable results. He will follow instructions, but it is doubtful whether the "b. coli" reported in the results should be ascribed to the water or the operator's fingers. There is no question but that filter results should be controlled by bacteriological tests, and to be of any great value such tests should be made daily. It is equally unquestionable that many of the smaller plants cannot afford a trained bacteriologist, nor can the state health department make the required tests, because of the burden of work that would result and the remoteness of location. Under these conditions recourse should be had to the independently practicing water chemist and bacteriologist, who can look after the tests for a number of plants.

Another feature of operation in which improvement can be effected is in the application of coagulant. Usually, in order to be sure of a "floc" too much coagulant is used. The laws of coagulation are sufficiently well known so that by a study of conditions and the analyses of the water, it is possible to prepare diagrams showing the amounts of coagulant to use for various conditions of the raw water, thus effecting a considerable saving.

In the smaller plants, as a rule, operating conditions are not all that could be desired, and there is very likely to be a gradual deterioration of plant equipment. For this reason there should be a periodic inspection by an expert, followed by such overhauling as he may recommend. This will prevent the deterioration reaching the point where permanent damage results, or becoming detrimental to the quality of the effluent.

Improvements in Present Design Practice.

In discussing future improvements it is convenient to divide filtration plants into two groups, those filtering over ten million gallons of water per day, and those of smaller capacity. Improvement can be effected in the coagulating and settling process in plants of all sizes, in respect to the point and manner of introducing the coagulant, in the method and degree of mixing the coagulant with the water, and in the design of the settling basins, to secure, as far as possible, a uniform flow. But there are limits to these improvements, as these processes are very much subject to the vagaries of wind, weather and temperature, so that a certain amount of inefficiency in them is unsurmountable under practical conditions.

In very large plants, especially where the water is softened, the difficulties of handling the enormous amounts of chemical are considerable, and much improvement can undoubtedly be made. This improvement can only be based upon actual experience, since so far only four of these monster plants have been built.

FIG. 4—PANORAMIC VIEW OF THE WEST SIDE MECHANICAL WATER FILTER PLANT AT CLEVELAND, OHIO.

As regards small plants, and particularly those serving populations of 10,000 or less, the tendency to copy from larger plants has already been remarked. Here a considerable simplification should be made over present designs, which should reduce the first cost. There should be greater ruggedness, both of the structures and of the apparatus. The temptation to introduce automatic devices of delicate construction into filtration plants seems to be irresistible to many engineers. The operator of the small plant is not a watch-maker or a safe expert, and has neither the time nor the inclination to fuss with delicate mechanism or to study out a complicated system of levers and gears. There is no function in water purification where mechanism is required for which a simple apparatus will not suffice. Such apparatus should be of simple and durable construction, and should operate on principles which can be understood by the type of men who will have charge of it.

Sewage Disposal Works in Reconstruction Period

By Harrison P. Eddy, of Metcalf & Eddy, Consulting Engineers, 14 Beacon St., Boston, Mass.

The general postponement of municipal construction of all kinds during the last two years has led to a large accumula-

tion of such work for which there is now more or less urgent demand. Naturally, consideration is being given to the order of precedence of work to be undertaken, and it is not always easy to decide which of several municipal improvements is most urgently needed, and what expenditures are justified. It may, therefore, be of interest at this time, to give consideration to data relating to the cost of some sewage disposal projects built under ante-war conditions and to the proportion of the budget likely to be required to meet annual charges. Some of the figures given were used by the writer in an address before the Dayton Engineers Club in 1916, and were published in Volume III of its Procedures.

Total and Per Capita Costs of Sewage Disposal Works

Data are given in Table I, showing the total and per capita costs of sewage disposal works for two large Metropolitan Districts at Boston, for the City of Worcester, a middle size industrial centre, and for Fitchburg, Gloversville and Clinton, three relatively small industrial communities.

Description of Works

The Metropolitan systems serve very large populations and comprise intercepting sewers, pumping stations and harbor outfalls, as the sewage is dosposed of by dilution in Boston Harbor. This method is frequently assumed to be particularly simple and relatively inexpensive, yet it will be seen from the figures given that the per capita costs are very similar to those of the smaller cities, where sewage treatment has been provided.

At Worcester, the cost given includes the intercepting sewers, the sewage treatment plant and sewers and drains required for providing separate systems of drains and sewers in certain large districts previously served by combined sewers. The sewage treatment plant comprises a chemical precipitation plant, including sludge presses, capable of treating all of the sewage of the city, and over 70 acres of intermittent sand filters capable of treating about 25 % of the city's sewage.

TABLE I—CONSTRUCTION COSTS OF SEWAGE DISPOSAL WORKS

Project.	Cost to Dec, 31, 1915.	Population for which works were designed.	Cost per capita for population for which works were designed.	Cost per capita for population at time project was authorized.
North Metropolitan System—Boston Dilution in Harbor	$7,126,000	571,000	$12.48	$23.09
South Metropolitan System—Boston Dilution in Harbor	8,944,000	986,000	9.06	35.65
Worcester, Mass.—		*267,000		
Chemical precipitation and sand filtration	1,966,000	**163,000	9.31	25.60
Fitchburg, Mass.—Imhoff Tanks and Trickling		†87,000		
Filters	815,000	‡47,000	12.88	21.55
Gloversville, N. Y.—				
Sedimentation Tanks		‖30,000		
Trickling Filters		¶7,500		
Post-Filter Settling Tanks and Sand Filters	378,000	§20,000	15.26	20.20
Clinton, Mass.—Intermittent Sand Filters, Outfall Sewer and Pumping Sta.	149,000	x18,750	7.96	12.33
Average of per capita costs			11.16	23.05

* Applies to intercepters, separating system and new outfall sewer.
** Applies to sewage treatment plant and old outfall sewer.
† Applies to intercepter.
‡ Applies to treatment plant—part for 55,000—part for 40,000.
‖ Applies to intercepter and treatment plant, excepting sand filters and sludge beds.
¶ Applies to sand filters.
§ Applies to sludge beds.
x Assuming 750 persons per acre.

At Gloversville unusually elaborate treatment works were provided because the sewage mingled with large quantities of industrial wastes, is discharged into a very small creek, the condition of which had been the subject of litigation for many years prior to the completion of the sewage treatment plant. These works comprise an intercepting sewer, vertical flow sedimentation tanks, trickling filters, humus sedimentation tanks, intermittent sand filters and sludge drying beds.

The City of Fitchburg is provided, for the most part with combined sewers. The works provided for the solution of the problem of disposal, comprise an intercepting sewer, an outfall sewer consisting of a long cast iron inverted siphon, Imhoff sedimentation tanks, trickling filters, humus sedimentation tanks and sludge drying beds. While it is essentially a manufacturing city, a very small quantity of industrial wastes is discharged into the sewer system.

It will be seen that the per capita cost of the several disposal works included in Table I, varied from $7.96 to $15.26,

TABLE II—INTEREST, MAINTENANCE AND OPERATION COSTS OF SEWAGE DISPOSAL WORKS, 1915

Project.	Interest on Investment at 3½% per capita.	Maintenance and Operation Cap.	Total per capita.	Est. total population of district 1916.
No. Metrop. System, Boston—Dilution in Harbor	$0.41	$0.29	$0.70	601,810
So. Metrop. System, Boston—Dilution in Harbor	0.71	0.25	0.96	438,580
Worcester, Mass.—Chemical Precipitation and Sand Filtration	0.43	0.37	0.80	162,697
Fitchburg, Mass.—Imhoff Tanks and Trickling Filters	0.72	0.26	0.98	39,656
Gloversville, N. Y.——Sedimentation, Trickling Filters, Post-Filter Sedimentation and Final Filtration through Sand	0.63	0.27	0.90	21,178
Clinton, Mass.—Intermittent Sand Fil., including Pumping	0.39	0.57	0.96	13,192
Average	0.55	0.33	0.88	.....

TABLE III—NET CITY EXPENDITURES PER CAPITA, 1915.
(Data from U. S. Census Financial Statistics of Cities)

Item.	Worcester, Mass. Est. Pop. 157,499		Dayton, O. Est. Pop. 123,794		Ave. of 44 Cities Pop 100,000 to 300,000 in 1915	
	Expenditure.	Proportion.	Expenditure.	Proportion.	Expenditure	Proportion.
Gen. government	$0.97	4.1%	$1.18	7.1%	$1.17	6.1%
Police	1.78	7.6	1.32	7.9	1.60	8.3
Fire	1.77	7.6	1.44	8.7	1.73	9.0
Other protection	0.11	.5	0.09	.5	0.18	.9
Health & sanitation	1.77	7.6	1.14	6.9	1.53	8.0
Highways	3.14	13.4	1.73	10.4	1.98	10.3
Charities, Hosp. & Corr.	1.74	1.4	0.65	3.9	0.68	3.5
Schools & Education	6.77	28.9	4.49	27.0	5.08	26.5
Libraries	0.50	2.1	0.37	2.2	0.22	1.2
Recreation park and playground	0.63	2.7	0.28	1.7	0.60	3.1
Miscellaneous	0.43	1.8	0.39	2.3	0.34	1.8
Water supply	0.57	2.4	0.97	5.8	1.10	5.7
Interest	3.25	13.9	2.60	15.6	3.00	15.6
Total of items shown	23.43	100.0	16.65	100.0	19.21	100.0

based upon the populations for which the works were designed to relieve. It is customary, however, in building such works, to make liberal allowance for the growth of the communities in the future, provision frequently being made for populations estimated to be tributary to the works in from 20 to 40 years after the date of their design. The effect of this allowance is shown by the difference in cost per capita of population for which the works were designed, and that obtaining at the time they were authorized.

Interest, Maintenance and Operation Charges

The interest, maintenance and operation charges for these works are given in Table II.

It is rather surprising to find that the cost of disposal by dilution in Boston Harbor, where operation costs consist chiefly of pumping the sewage, is practically the same as that in the smaller communities, where sewage is treated by artificial processes.

It is not easy to decide in all cases what proportion of its annual income a community is justified in expending for the treatment of its sewage, and the payment of annual charges upon its disposal works. In this connection it is interesting to note the proportion of annual income devoted to each of the principal municipal activities. Such a sub-division of expenditures is given in Table III, for Worcester, Mass., Dayton, Ohio and 44 cities in this country having a population of from 100,000 to 300,000. These figures are taken from the 1915 U. S. Census, Financial Statistics of Cities.

The figures in Table III are not given with the idea that they can be applied directly to any community, but rather to give those interested the opportunity to make such comparisons in specific cases as may appear to be justified.

In considering the cost of maintenance and operation of sewage disposal works, Table II, it should be noted that in the six cases cited, the disposal works whether they comprise pumping stations or sewage treatment plants, are faithfully operated under skilled supervision. In this respect they differ from many more or less similar works which after completion are practically abandoned and perform only a limited part of the service for which they were designed and which they are capable of rendering under proper operation and maintenance.

Proper Operation and Maintenance

This failure properly to operate sewage disposal works is a matter of serious importance to the public. The need of accomplishing a specific result at the minimum cost, has led to the highly technical bacterial methods of disposal, which require skilled supervision to ensure their good operation. Lack of such supervision leads in many cases to failure, which is not the result of faulty design, but of operation, and indicates that a campaign of education is necessary to bring home to the public the necessity of appropriating adequate funds for proper operation and maintenance of their sewerage works.

A New Line of Steam Shovels

Because the sentiment of the country is strongly for the rapid completion of a universal system of dependable highways, and realizing that road-building machinery of the future must have a wide range of usefulness, a complete new line, the Type OO Series, has been added to the line of earth moving and handling equipment produced by the Thew Automatic Shovel Co., Lorain, Ohio. This machine is equipped either as a full-circle swing shovel or crane, and is provided with either steam, gasoline or electric power. For regular shovel work, it carries a ½-yard dipper. Double-drum mechanism may be furnished for clam-shell or crane operation. It weighs only 14 tons.

City Pavements for State Highways in Connecticut

By Charles J. Bennett, Mem. Am. Soc. C. E., State Highway Commissioner, Hartford, Conn.

The State Highway Department of Connecticut has committed itself within the past six years to the policy of constructing hard surfaced pavements on heavily travelled state highways.

Inter-City Hard Surfaced Roads

Many of the highways through the thickly settled sections of the state are subjected to a traffic equal in weight, if not in amount, to that on the main streets of a large city. The centers of population are manufacturing towns, and the traffic between towns demands service for the entire year. With the ordinary type of highway, such as gravel or macadam, this is not practical, or, if practical, causes such a large expenditure for maintenance as to make it unwise to construct this cheaper type of pavement. On that account, many miles of hard surfaced pavement, either of concrete or improved pavement with a concrete base, have been constructed with the result that motor vehicles are operating for the entire year over these sections with comfort and very little inconvenience.

The Burnside Avenue Pavement in East Hartford

As an illustration of the above practice, during the season of 1918, the Department constructed approximately 20 miles of this type of pavement under the extremely adverse conditions of the labor and material market, and at a cost which, in ordinary times, would have been considered excessive. Nevertheless, the result of the improvement seems to indicate that the expenditure was justified. A particular instance which can be used as an example is the improvement of what is known as Burnside Avenue in the Towns of East Hartford and Manchester, lying between the City of Hartford and the Town of Manchester, Conn. and on the main route from Hartford to the easterly portion of the State.

Practically all of the road from Hartford to Manchester had been improved by the State, but on one particular section approximately two miles in length, the pavement was old and worn thin. A macadam road had been constructed and was giving considerable trouble at certain seasons in the year on account of breaking through, and was rough and full of cup holes practically all of the time. The cost of maintenance had increased to practically $1,000 a mile, and it was considered advisable to construct a new pavement during the season of 1918.

Sheet Asphalt on a Concrete Base

The type of road selected was sheet asphalt pavement on a concrete base. The work was of such a character that it was possible to figure the excavation per square yard very easily, as it was practically of a standard depth for the entire length of the highway to be constructed. Consequently, the price bid was on the basis of a square yard, and the entire cost of pavement, including excavation, 6 ins. of concrete base and 3 ins. of sheet asphalt top, was awarded for $2.50 per square yard. The concrete base was laid in the proportion of 1 part of cement, 3 parts of sand and 6 parts of crushed stone. The sheet asphalt was of standard type, consisting of 1½ ins. of binder and 1½ ins. of top laid under the standard specifications for sheet asphalt pavements.

Many Mechanical Devices Employed

On account of the extremely bad labor conditions, it was necessary to employ as many mechanical devices as was possible. Inasmuch as there was a trolley line located alongside, or in the highway, for the entire distance, the crushed stone for the concrete base was delivered by trolley cars and dumped directly in place on the sub-grade, so that it could be handled directly into the mixture. Sand was delivered in the same manner.

The sub-grade excavation was done by employing a steam shovel of the ordinary highway type which broke up the

old macadam road and loaded it into carts for delivery on side roads which were hardened by the use of the old stone. Sufficient excavated material was left to construct the shoulders against the new asphalt pavement.

On acount of the possibility of greater speed in delivery, the hot mixture for the asphalt surfacing was delivered by motor truck from a permanent plant located in the City of Hartford, with an approximate haul of six miles. There was no difficulty experienced in delivering the mixture, but on the whole, this method of delivery was satisfactory.

The pavement mixture was sampled by chemists at the plant in Hartford, and careful records kept of the mixture.

The work was done, under the supervision of the State Highway Department of the State of Connecticut, by the Edward Balf Company, general contractors of Hartford, Conn.

Some Design and Constructional Features of the Rideau River Intercepting Sewer, Ottawa, Canada

By L. McLaren Hunter, of City Engineering Department, Ottawa, Ontario, Canada

The Rideau River Intercepting Sewer is located in the southern district of Ottawa, Ontario, and is 17,900 ft. long. It was constructed to drain a portion of Ottawa South, and to give a greater depth for house drainage in other portions of the same district. It will also drain a part of Ottawa East.

The city engaged the firm of consulting engineers, R. S. & W. S. Lea, of Montreal, to make a report on the necessity for and the design of the interceptor.

In designing the interceptor it was important to adopt such a route and grade as would permit of its convenient incorporation in the main drainage scheme which must be provided eventually for the whole city of Ottawa and suburbs.

The area of the section drained is 1,060 acres, 36 per cent. of which (380 acres in the Ottawa South and Ottawa East districts) is already sewered on the combined system.

The present main sewer has its outlet in the Ottawa River at Edwards Mill, at the foot of John Street, and crosses the canal at Somerset Street, where the Rideau River Interceptor commences. Some of the features of the Rideau Interceptor are here described as reported by Mr. Hunter to The Canadian Engineer.

Sections

The first section was constructed of segment tile 60 ins. in diameter, running from Somerset street to the Gas Company's property. The next section, of 54-in. pipe (part segment and part concrete pipe) runs from the Gas Company to Clegg street. The section from Clegg to Windsor was constructed of 48-in. concrete pipe—(this is being continued along Windsor to Bank and Grove street and is called the Ottawa South sewer extension, although really an extension to the Rideau interceptor). A 30-in. concrete pipe is carried along Cameron to Leonard. This extension is 4,000 ft. in length.

Work was commenced in December, 1915, by day labor, under Foreman J. J. Sullivan, a concrete bellmouth being built, 60 in. off 84 in. at 40 ft. radius to connect with the main drain. A gang of 72 men were employed during the winter of 1916-17 and rapid progress was made.

The gradient for the whole length of the interceptor was 1 in 1,000, three crossheads being used every 100 ft. for sighting purposes.

Tunnel Section

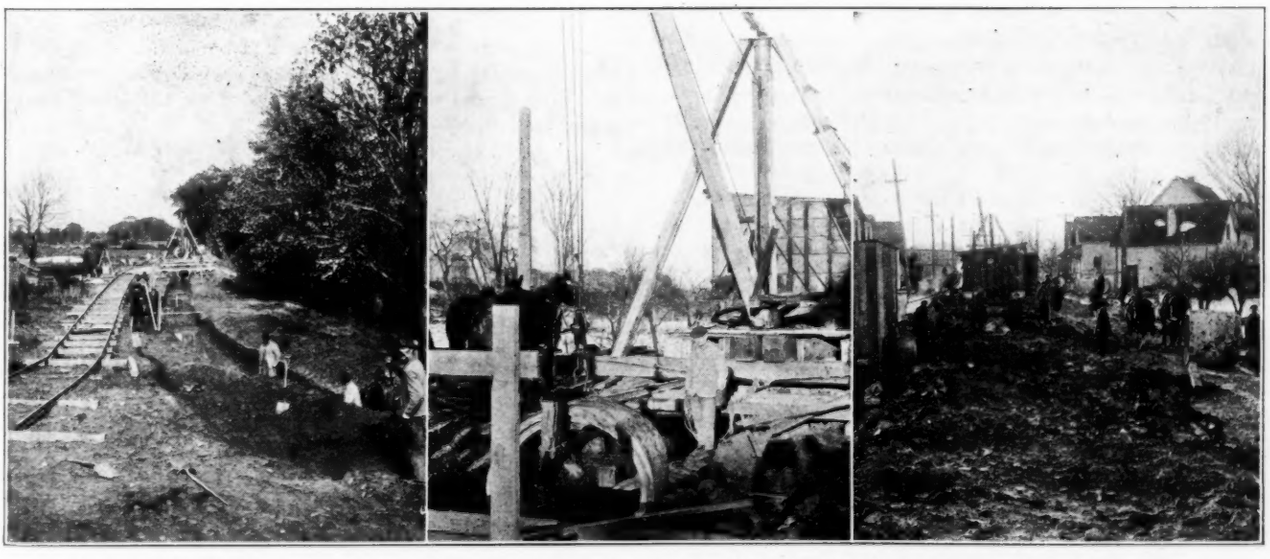
The most interesting part of the work so far was the tunneling operations carried out in 1916 under the Canadian Pacific and Grand Trunk railway tracks. This tunnel was commenced just northeast of Hurdman Road and was carried across the tracks for a distance of 400 ft. The average depth below ground level was 24 ft. A night and day gang were kept constantly at work on the tunnel, the progress made being 6 ft. per shift. Four men were kept laying the tile and two digging ahead, six men in all composing the gang.

The tunnel drum used was constructed of boiler plate riveted together and braced by angle iron, the "peak" (or the 8 ft. end) being placed where the "mucking" operations were carried out. This peak allowed plenty of space for the laying of the tile behind. The drum was driven ahead by screw jacks as the "mucking" operations progressed. For most of the way the tunnel was pushed through hardpan and river clay. At one portion, however, quicksand was struck and there an air blower was used which stiffened it sufficiently to allow the work to be proceeded with. This section from Somerset street to Hurdman road had an underdrain laid 9 in. in diameter.

The Lees Avenue section was constructed of 54-in. tile during 1917. Quicksand was found most of the way, and truss braces had to be used for holding up the bank. Double sheeting and the wood haunches had to be left in the trench.

The tile for the 60-in. and 54-in. sections was supplied by the Natco Tile Company at a cost of $5.65 per lineal foot.

When about a quarter of the work was done on the 54-in. section Commissioner of Works Macallum decided to call for



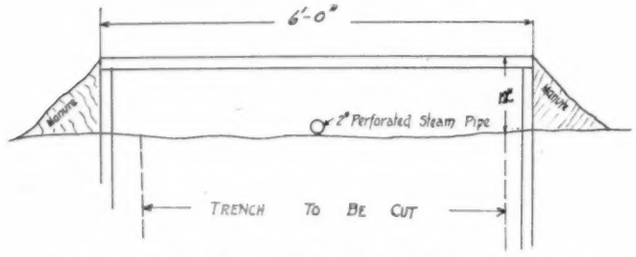
VIEWS ON CONSTRUCTION OF CONCRETE PIPE SECTIONS OF RIDEAU RIVER INTERCEPTING SEWER.
Left: Light Railway for Pipe Conveyor—Center: Lowering 3,300 Lb. Section of Concrete Pipe into Place—Right: Method of Rolling Pipe to Trench, by Team, Found More Economical than Light Railway.

tenders for reinforced concrete pipe. The tender of B. Blair & Co., of Woodstock, Ont., was accepted, at $4.34 per ft. for 54-in. pipe, and $3.44 per ft. for the 48-in. pipe. This meant a saving of $1.92 per ft. for the 54-in. pipe and $3.41 per ft. for the 48-in. pipe. This step taken by the Commissioner saved the city $19,000; $15,400 in the cost of pipe, and $3.600 in the cost of laying it.

By the end of 1917 the work had been carried as far as Main street, next to the Williams property. Further progress was delayed by a disagreement between the city and Mr. Williams over the price of a strip of land where the sewer was to be built. This dispute was settled in July, 1918, and the work was recommenced in August.

Handling Pipe

The work of conveying the pipe from where the contractors had dumped them caused delays and entailed a great deal of expense. At first a track was built and a light carriage made. This was drawn by horse to the derrick but the lifting and laying of track always delayed the work of pipe laying for several days. The difficulty was overcome by providing two wheels which were inserted into the pipe and tightened by wooden wedges; through the center was a 2-in. steel spindle



THAWING BOX USED ON RIDEAU RIVER SEWER EXCAVATION.

which protruded about 9 ins. past the edge of the pipe on both sides; a team was hitched to this and the pipe drawn to the job like a large roller. With this device there are no delays in pipe laying, the work going on steadily day by day. The highest record reached in pipe laying was 124 lin. ft., the average being 72 lin. ft. per day of nine hours.

It has been decided to push this work ahead during this winter in an endeavor to finish it by next August.

Thawing Ground

To cheapen the cost of excavation during the winter months when the frost has penetrated deeply into the ground a box has been built, as shown in the sketch herewith. This is laid each night about 60 ft. in length (sufficient for a day's work). Into this box a 2-in. steam pipe is run, perforated every 18 ins., and steam is kept on at high pressure. In the morning the ground has thawed out and digging is comparatively easy.

To keep the fresh cement in the joints from freezing, two brick heads are placed in the interior of this pipe where the cement is still green and steam is kept circulating between them.

Equipment Used

The following is a list of some of the larger equipment used during construction: 1 45-h.p. boiler (steam), 1 40-h.p. boiler (steam), 1 derrick and 1 traveler, 3 syphons, ¼-in. submerged pump (electric), 1 4-in. suction pump (electric).

Cost of Materials

The costs of various materials used are as follows:

1917—54-in.	concrete pipe	$4.34 per ft.
48-in.	concrete pipe	3.44 per ft.
1918—48-in.	concrete pipe	4.30 per ft.
30-in.	concrete pipe	2.35 per ft.
1917—60-in.	Natco tile	5.65 per ft.
1916—Cement		.43 per bag
1917—Cement		.52 per bag
1918—Cement		.73 per bag

Cost on 60-in. Segment Block Section

On the 60-in. Natco tile section in 18 ft. of excavation the costs were as follows:

	Lin. ft.
Excavation and backfilling	$ 8.240
Pipe laying	.375
Natco tile, including underdrain	7.427
Pumping	.766
Shoring	.652
Grading plant, sundries	1.744
Total cost per lin. ft.	$19.204
Tunnel section (excavation) per ft.	$19.37
Manholes (concrete) each	$61.46

Cost on 48-in. Concrete Pipe Section

The cost of 48-in. concrete pipe section in 4 ft., 6 ins. of excavation this year was as follows:

Labor

	Lin. ft.	
Excavation	$1.37	
Shoring	.68	
Pumping	.20	
Backfill	.60	
Culvert drains (draining property)	.16	
Rolling pipe	.29	
Running hoist	.33	
Derrick and track	.44	
Grouting	.12	
Pipe laying	.34	
Sundries (including Saturday afternoon holidays for laborers)	.58	
		$5.11

Material

Pipe (including hauling)	$3.60	
Coal	.24	
Cement	.11	
Sundries	.11	
		$4.06
Total cost of interceptor per ft.		$9.17

The above costs on the 48-in. section were taken on 400 lin. ft. of work which was done in August, 1918. On the Williams property laborers were being paid 35 cts. per hour. On this section and on the Natco tile section 1916 laborers were being paid at 27½ cts. per hour.

Work by Day Labor

The whole of the construction work was done by day labor, the assistant engineer in charge to Main street being W. F. M. Bryce (now overseas), the writer taking his place and is carrying the work to completion. Mr. F. C. Askwith supervised the work from the beginning and latterly Mr. A. F. Macallum, the Commissioner of Works.

The Rideau interceptor will cost $300,000 and the extension to the interceptor $50,000, making in all a total of $350,000.

When this work is finished another drainage scheme will require to be commenced for that part of Ottawa southwest of Leonard and south of Cameron. This will be built in the separate system, the surface water being drained into the river and the sewage pumped into the present interceptor at Leonard and Cameron. Preliminary surveys and levels are at present being made for this.

The city has expropriated a strip of land along the whole

bank of the river where the interceptor is laid; this strip averages 50 ft. in width. The intention is to build a new driveway later on to connect up with the Federal Government's driveway system.

Reclamation of Swamp Lands in Dane County, Wisconsin

By W. G. Kirchoffer, Sanitary and Hydraulic Engineer, Madison, Wis.

There are thousands of acres of swamp lands in Dane County, Wis., which have been of little value in the past for want of drainage. Up to the year 1907 little was done towards the drainage of these lands for the reason that our drainage laws previous to that time were so drawn that they did not favor the formation of drainage districts. That is to say, they gave the few, who were opposed to drainage, so much power in the matter that it was difficult for those land owners favoring drainage to organize the district and get the drainage work under way.

Fourteen Drainage Districts Organized

But, this has all been changed. In 1907 the Legislature gave us a most excellent drainage law so that now it is a comparatively easy matter for a number of farmers to get together and organize a district. Within the last ten years 14 such districts have been organized, involving the drainage of 129,349 acres of marsh and swamp lands, owned by approximately 915 farmers. These fourteen districts are all within a radius of 25 miles of Madison, Wis. The work of excavating the main and lateral ditches has been completed upon all of them except the Door Creek and the Lower Badfish, upon which the contracts have not as yet been awarded. The work on the Middleton is still in progress. The Springfield, Sun Prairie and upper Door Creek failed to organize.

Open Ditches

The work undertaken by most of the districts as an organization, or corporation has been to straighten and deepen the creek or main drainage line of the marsh under consideration, or, if there is none, to provide a main outlet. Lateral ditches in some of the districts have run from the main ditch so that each land owner has an outlet. No attempt is made to complete the work of drainage by laying drain tile, but this work is left for the sub-drainage districts to do, such as the Orchard Farm Garden and 1st addition to Orchard Farm Garden which are sub-divisions of the Starkweather District. In some cases this work is left for each farmer to do as he chooses, or as he may find it necessary to do.

The Ditches

These main ditches vary in bottom width from 4 to 30 feet, according to the amount of water they have to carry. The main ditches in the Shephard, Koshkonong and Starkweather drainage districts are the largest, that of the latter being 30 feet wide at the point where it passes the beet sugar factory into Lake Monona. The depth of these main ditches varies from 4 to 7 feet, according to the topography of the land and the distance from the outlet. The lateral ditches are usually 3 feet wide on the bottom and from 3 to 5 feet deep.

The total length of ditches in each district are as follows:

Albion	61925 ft.
Badfish, Upper	30480 ft.
Badfish, Lower	137150 ft.
Door Creek	60000 ft.
Koshkonong	152940 ft.
Medina	27085 ft.
Middleton	31969 ft.
Nine Springs	49632 ft.
Rattlesnake	107692 ft.
Rutland	25800 ft.
Starkweather	99991 ft.
Shephard	98900 ft.

The average number of feet of ditch per acre varies from 23.3 feet in the Medina Drainage District to 46.7 feet in the Albion district.

Digging the Ditches

These drainage ditches are usually dug with slopes of 1 to 1 so as to prevent their caving when the excavation is done with a dry land machine, but where floating dredges are necessary the side slopes are very steep, which is an objectionable feature of floating dredge work. In determining the amount that each land owner shall be assessed the commissioners in charge of each district look the lands over and, after reaching a decision as to what extent each piece if land will be benefited by reason of the contemplated work, levy an assessment accordingly.

Benefits

The benefits are usually based on the difference in the estimated values of the land before and after drainage. The total benefits accruing to the lands in each district as estimated by the commissioners are as follows:

Albion	$ 49,446.35
Badfish, Upper	35,728.40
Badfish, Lower	150,748.00
Door Creek	139,118.00
First Addition to Orchard Farm	33,801.00
Koshkonong	167,570.00
Medina	10,525.00
Middleton	37,577.00
Nine Springs	50,571.00
Orchard Farm Garden	50,481.00
Rattlesnake	66,816.00
Rutland	10,073.25
Shephard	87,828.51
Starkweather	147,106.00
Total	$1,037,389.51

Damages

Besides estimating the amount of benefits which will accrue to the land, the commissioners also estimate the benefits to the highways and railroads. In some cases there are damages to pay, as for instance, when dry land is taken for the right-of-way of the ditch, culverts have to be lowered, or railroad companies are compelled to open bridges to allow dredges to pass. As a rule the cost of this work does not amount to as much as the estimated benefits. This cost is usually stated as a percent of the benefits in arriving at the amount each owner should pay. This percentage varies in the different districts according to the local conditions and the judgment of the commissioners, but usually it is betwen 25 and 35 per cent.

Cost Per Acre

The estimated cost per acre in the different districts, including the cost of engineering and organization is as follows:

	Cost per acre
Albion	$ 9.26
Badfish, Upper	8.73
Badfish, Lower	19.78
Door Creek	17.41
*First Addition to Orchard Farm	35.92
Koshkonong	8.25
Medina	5.54
*Middleton	41.40
Nine Springs	12.10
Orchard Farm Gardens	24.50
Rattlesnake	4.71
Rutland	11.00
Shephard	7.17
Starkweather	10.20
Average	$12.96

*War Prices.

The large variation in the cost per acre is caused by the difference in the size of the contract, the number of lateral ditches put in and whether or not the work was done before or during the war. The Rattlesnake district has the lowest cost but it is the poorest drained. The Middleton is the highest but it has the smallest area, a long costly main ditch, many railroad crossings and the contract was let under war prices.

Contests

Besides the actual cost of the work of digging the ditches, engineer's, commissioner's and lawyers' fees and court organization expenses, to be paid, there have been contests between the districts and land owners, railways and one district with another district. Some of the districts have had very little trouble in this respect, as for instance, the Albion Drainage district located near the city of Edgerton. This district had only one remonstrance that amounted to anything and this was made by the city of Edgerton. They remonstrated because they thought the district would turn such large volumes of water into Saunders Creek that the city would be flooded, but they later changed their minds and withdrew. Experience has proven that their fears were groundless.

The larger districts naturally have more trouble than the smaller ones because of the greater number of people involved. At one time the Shephard district had 57 different farmers objecting to the work or assessment. The Rattlesnake and Koshkonong districts likewise have had much trouble. The Rattlesnake district dug their ditches first with the ideas of draining into the Koshkonong ditch when it was dug. The commissioners of the two districts could not agree on the amount to be paid by the Rattlesnake district for the benefit they would derive from the excavation of the Koshkonong creek so the case was taken into the courts where it was fought for several years. A decision was granted in faver of the Koshkonong drainage district by the Supreme Court. The court expenses were more than the assessment levied.

Seven Foot Pond Changed to Corn Field

The benefits received by proper drainage are indeed great and there can be no doubt as to the feasibility of draining marsh lands when the fall is sufficient to warrant it and the soil contains the proper ingredients for the production of crops. Already in the short time that this work has been under way, corn has been raised where a few years ago there was a pond of water 7 ft. deep and this without intensive drainage.

Secondary or intensive drainage has only been taken up in a large way within the last three years.

Tile Drainage.

The Orchard Farm Garden District, a sub-drainage district created out of the Starkweather district was the first to organize and has an area of 680 acres and is tile drained with 4, 5, 6 and 8 in. tile into the ditches of the Starkweather drainage district. The lines of tile are spaced 8 rods apart and the shallowest depth is 3 ft. Where possible a fall of 1 ft. in 1000 ft. is used. The majority of the area of the district has been under cultivation for the past two years.

Crops

The first year the owners (real estate men) put the plowed portion into sugar beets but this last season it was rented out for truck garden purposes, in tracts of 10 to 15 acres each. The rental was $15 per acre. One gardener put 15 acres into onions which yielded about 600 bushels per acre. This subdrainage district appeared to be such a success that 19 other landowners in the Starkweather district got together and organized the First Addition to the Orchard Farm Garden Drainage District. The spacing of the tiles in this district was the same as in the Orchard Farm Garden, but no 4 in. tiles were used except on a small tract where the spacing was 66 ft. These tile were all laid with a depth of 3½ ft. at the upper end and a fall of 1 ft. in 1000 ft. except a few main lines which were laid as flat as 0.6 ft. per 1,000 ft. The soil in the first Addition is principally clay and sandy loam whereas that of the Orchard Farm Garden is principally peat. It is nearly all underlaid with sand or gravel.

Personnel

Nearly all of the engineering work on these districts has been done by engineers located in Dane County. Besides the writer, Mr. P. H. Hintze, County Surveyor has acted as engineer for the majority of the districts.

The work of managing the affairs of these districts demands the services of men who have had experience along drainage lines. Mr. George E. Brown, of the Town of Burke is acting as commissioner on the Koshkonong, Starkweather, Nine Springs, the Middleton, Door Creek, Lower Badfish, Orchard Farm Garden and 1st. Addition to Orchard Farm Garden Drainage District and is now making a specialty of this work as the duties of Secretary on all of these districts require all of his time.

Prospective Work

All of the work now under construction, or which has been planned, will be done inside of three or four years when the benefits secured by the draining of land can be seen by those who at present have not faith in its ultimate success.

Performing Municipal Construction Work by Day Labor in Flint, Michigan

By Ezra C. Shoecraft, City Engineer, Flint, Michigan

The Charter of the City of Flint requires that all work which is paid for by special assessment shall be advertised and that bids shall be solicited; but it is left to the judgment of the Common Council as to whether the bids are satisfactory. If the bids seem too high or if they are unsatisfactory, then the bids may be rejected and the work done by day labor, said Mr. Shoecraft in addressing the annual convention of the Michigan Engineering Society.

Sewers, Pavements, Sidewalks

Sewer construction by day labor was begun in a small way in 1910 with very satisfactory results. This happened to be a segment block sewer, the first sewer of this kind of material ever constructed. During each succeeding year, small sewers were constructed until the year 1915 when the city undertook the entire sewer program. The city has done all sewer work by day labor since that time.

Sidewalks by day labor were begun in 1912 and have been so built since that time.

The day labor plan for pavements was begun in 1914. During that year 2.36 miles of concrete pavement were constructed. In 1915 all of the pavements were built by day labor, and except for a small amount of asphalt block pavement laid in 1917 all of our pavements since that time have been put in by day labor.

The construction of pavements, sewers, and sidewalks by day labor under the direction of the City Engineering Department in Flint started very much like Topsy, "It just happened."

The organization of our department is very different from the ordinary City Engineering Department, for the reason that we must, in addition to having men qualified to design, have men who are capable of directing work and handling men. This is a huge problem for the reason that men who are so qualified are very much in demand and contractors are continually on the lookout for them.

Volume of Day Labor Work in Flint

To give some idea of the volume of the work done by day labor by our department. note the following:

	Miles of Sewer	Miles of Pavement	Sq. Yds. of Pavement	Miles of Sidewalk	Sq. Ft. of Sidewalk
1910	0.23				
1911	0.86				
1912	.35			1.73	45,582
1913	5.12			5.02	132,620
1914	3.0	2.36*	19,381.4	9.5	250,800
1915	21.2	7.0	85,522	7.2	191,000
1916	20.55	8.39	109,070	17.5	462,000
1917	26.59	8.27	139,423	16.7	452,736
1918	15.06	3.92	52,106	13.68	361,540
	92.96	29.94	405,502.4	71.33	1,896,278

*Concrete.

Construction Equipment Owned by the City

To do this work we have the following equipment. No mention will be made of small tools:

For Sewer Construction: 1 Austin excavator capable of excavating a trench 15 ft. deep and 36 ins. wide; 1 Parsons excavator, capable of excavating a trench 20 ft. deep and 60 ins. wide; 1 Potter sewer machine for large sewers; 1 Parsons backfiller; 2 600-gal. Novo trench pumps.

For Pavement Construction: 1 Type O Thew revolving steam shovel; 1 Model 14B Bucyrus revolving steam shovel; 2 Coltrin concrete mixers for curb work; 2 14-ft. Milwaukee batch concrete mixers for foundation work; 1 10-ton Kelly Springfield road roller; 5 2½-yd. Troy asphalt wagons; 1 Hetherington & Berner asphalt plant capable of manufacturing mixture equal to 1,500 sq. yds., 2 in. A. C. surface in 10 hrs.; 1 8-ton Austin tandem gas asphalt roller; 4 G. M. C. 5-ton trucks with steel dump bodies; 1 Nash 2-ton truck; 1 Haiss wagon loader; 6 Studebaker dump wagons; 1 Byers auto crane; 1 Gravel pit equipped with Sauerman drag line.

For Sidewalk Construction: 2 Coltrine concrete mixers for cement work; 8 wheeled scrapers for grading purposes.

To the above equipment may be credited to a great extent the success of day labor work in Flint. This equipment is put on each separate job on a per diem basis, and is entirely self-supporting. Each year each machine is given proper depreciation.

Relative Costs

Naturally you would like to know relative costs. Relative costs of this city to any other city are of no value unless all of the items entering these costs are taken into consideration.

The last bids that we had for pavements was in 1915. That year our asphalt plant laid our pavements for $21,000 less than the same pavements would have cost had we accepted the lowest bid. The original cost of the plant including roller, wagon and small tools was approximately $15,000.

We have, however, compared our costs on all of our different works with other cities and we find our costs very satisfactory.

Concrete Bridges Built by Contract

We have in the past five years built a number of new concrete bridges, and we have in each case done this work by contract. We have considered this the better plan for the reason that we did not have enough of the work to warrant us to maintain an organization for this particular class of work. Reinforced concrete bridge work is in a class by itself and needs men who are thoroughly experienced in that line of work. In addition, thereto, special equipment is usually needed for each bridge, and many times equipment which may be efficiently used on one may be entirely useless on another. If you noted the equipment which I stated above that we now operate, you will see that all of it is standard equipment which is generally usable. We have been very careful in the selection of our equipment not to buy tools which can only be applied to special jobs.

Street Cleaning

There is one class of municipal work which this department does and which should not be passed by, although it is not construction work. About one and one-half years ago the department of street cleaning was turned over to us and we have attempted to systematize it and put it on an efficient basis. We operate two power flushers, one is a 1,200 gal. Tiffin motor flusher and the other is a 1,800 gal. Mack flusher with Haiss equipment.

We have obtained excellent results with these machines and feel that our costs compare very favorably with other cities, but it is my opinion that still greater efficiency should be secured. Our costs for street cleaning approximate $.04 per sq. yd. per year. This includes pavement cleaning and snow removal. I believe that this is an engineering problem, and although I have given it considerable study I am not prepared to state at this time where I believe the greatest improvements can be made in this work. I am not satisfied as yet, that the ideal street cleaning machine has been invented.

Contract Versus Day Labor System

In the matter of day labor, I think there is a line and a very distinct line where work should be done by contract and where it should be done by day labor. It is my opinion that the small city should do their work by contract for the reason that they do not have a trained force capable of doing first class work, and it would be too expensive for them to maintain a trained force for the relatively small amount of work which the small city usually does. As regards the size of the city to which this would apply, I am not prepared to state for the reason that the size of the city does not necessarily signify the amount of work which that city may be doing. It is also my opinion that day labor does not apply to the large city of half a million or more, that is growing rapidly and doing extensive public work. The reorganization that is necessary to carry on such work is too cumbersome.

Conclusion as to Success of Day Labor in Flint

We believe, however, that in our city that the work by day labor has been satisfactory, that as a whole our costs have been less than they would have been by contract; that we get equally as good and generally better work done; that we have the work done more expeditiously by this method; that we give the property owners affected by any improvement, more consideration than the contractor does; that urgent work is given preference and done first; and, that better work can be done and the incentive to cheat is removed.

Dunn Wire-Cut Lug Brick Patents Sustained

The Dunn Wire-Cut Lug Brick Company of Conneaut, O., has been given the decision by the United States Circuit Court of Appeals of the Sixth District in its suit against Joseph Nicholson et al. of Toronto, Ohio, for infringement of patent. The court affirmed the validity of the Dunn patent on wire-cut lug paving brick, and states that an injunction should issue against Nicholson restraining him from making or selling the brick claimed by the complainant to be an infringement of the Dunn patent, and an accounting should be made by Nicholson to the Dunn Wire-Cut Lug Brick Company. This decision sustains every claim made by the Dunn Company.

The case has been in the courts for two years and the result is of interest to the paving brick industry, as wire-cut lug brick are being made by 48 companies, operating 72 plants in 12 states.

The suit grew out of the making and selling by Joseph Nicholson et al. of Toronto, O., of a wire-cut brick having lugs cut with a knife instead of wires. The Dunn Company sued Nicholson for infringement, claiming the Nicholson brick was a wire-cut lug brick within the meaning of the law and the understanding of the trade.

The Circuit Court of Appeals sustained this contention. It held that the Dunn brick was a new and useful invention; that the general use into which it had come aided establishing its character; that it was a better brick than other wire-cut brick and was produced by a simple means; that the invention was protected by a basic patent; that the method of cutting the

lugs made no difference, since whether the cutting be done by wire or knife or saw the methods are equivalent, and the Dunn Company is entitled to the protection of equivalent methods. A cutting wire, says the court, acts like the cutting edge of a knife and the cutting edge of a knife is, for this purpose, a wire; hence, all such brick, whether sliced by wire or knife or saw are in trade universally known as wire-cut brick; that Dunn's patent entitles him to the breadth of equivalency pertaining to an invention of that character; that the inventor may have a patent which covers the invention and gives a monopoly upon it regardless of great variations in the method of making; that the knife used by Nicholson was the perfect equivalent of the wire bent to the same form, and in the true sense of the patent cutting lugs by knife or saw or any other device sweeping through the clay is an exact equivalent of the Dunn method, and is therefore an infringement.

Both the Circuit Court and the Circuit Court of Appeals concurred in the finding regarding the Dunn Wire-Cut Lug brick that "the demand for this brick, following the test of actual service was such that the output rose from 2,233,000 in 1910 to 138,000,000 in 1915.

Economic Value of Electrically Driven Pumps for Small Water Works

By D. D. Ewing, Professor of Electric Railway Engineering, Purdue University, Lafayette, Ind.

The great development in motive power and power pumps within the last half century has placed the possibility of a reliable water works system within the reach even of rural villages. The period 1885 to 1905 saw the installation of public water works in many small towns. At that time about the only pumping power available was the familiar steam plant, consisting of a steam boiler and a reciprocating steam pump. Many of these plants have lived out their allotted days and the question of replacement is becoming a rather common one, said Professor Ewing in addressing the annual convention of the Indiana Engineering Society.

Within the last 15 years, several new types of pumps have been developed to a high state of perfection. This is true also of the electric motor. A study of water works statistics reveals a rapidly growing tendency to replace other pump motive powers with the electric motor. The subject of this article, therefore, is of pertinent interest not only in an academic way to engineers, but also in a highly practical way to municipal authorities, electric central station utilities, and manufacturers of pumping and power equipment.

Advantages of Electric Motive Power.

As practically all forms of so-called "power" pumps—centrifugal, rotary and displacement—can be adapted to electric drive, the questions arising relative to the application of electric motors to municipal pumping are those pertaining to first cost and operation rather than mechanical design. In brief the advantages commonly claimed for electrically driven pumps are:

Lower first cost
Lower operating expense
Greater compactness and simplicity
Require less attendance and are more convenient than other forms of drive.

Where water is pumped from widely separated wells electric drive is particularly advantageous. Pumps so driven may readily be arranged for automatic operation starting and stopping automatically at pre-determined pressures on the discharge mains.

The energy required by electrically driven pumps is usually expressed in kilowatt-hours per 1000 gals. of water pumped. This is not a very satisfactory duty unit as pumps work between wide ranges of suction lift and discharge head and their energy requirements, therefore, differ greatly. For large low head pumps the energy requirement may be as low as 0.4 Kw.-hr. per 1,000 gals. and for small high head pumps as high as 10 Kw.-hrs. For average conditions 1.25 Kw.-hrs. per 1,000 gals. seems a fair figure. The energy cost, of course, depends on the electric rates and they too vary through a wide range being dependent on size, kind and location of the central power station. These rates usually contain a demand charge and an energy charge both graded as to magnitude of the customer's requirements. A rough average flat figure for small stations is of the order 5 cts. per kilowatt-hour. For larger stations 2 cts. per kilowatt-hour is probably nearer the correct average.

Possibly the greatest objection that has been urged against electric drive is lack of reliability. This objection is based largely on the fact that the electric motor is not a prime mover but is dependent for its energy supply on transmission lines and the central station. As a matter of fact, however, for a small pumping plant consisting of but a single unit the electric drive is the most reliable of all power drives. The motor itself, if properly applied, is more reliable than either steam or internal combustion engines and the transmission line and central station are more reliable than is a single boiler.

Power Requirements

The engineer who applies an electric motor to a given drive must have a very accurate knowledge both of the characteristics of the motor and pumps and requirements of the drive if the application is to be successful. Too often the electric drive has been condemned as inherently defective, whereas, the defect lay in the application and not in the drive itself. The requirements in water works service are rather numerous, although in the main they are not difficult to meet.

As far as power driven pumps are concerned, waterworks systems may be classified as (1) direct pumping (2) pumping to storage (3) combination of the two systems. With the latter system it is not uncommon to shut off the storage line during a fire and pump directly into the mains at some higher pressure.

Several types of pumps are available and in general pumping can be classified into deep well and surface pumping. The latter class includes all of the suction lifts low enough to permit the pump being placed at the ground surface.

For deep well pumping displacement, centrifugal, propeller and air-lift pumps are in common use. No attempt is here made to discuss in detail the problem of pump application to a given service, rather it is to limit the discussion to the requirements of different types of pumps from the standpoint of the application engineer. For the displacement pumps, that is those using a plunger or a piston, a pumping head to change the rotary motion of the motor to the reciprocating motion of the pump is necessary. This head must be geared to the motor because the lowest economical motor speed would still be far too high for the pump. Centrifugal and propellor pumps for deep well pumping are driven by direct connected vertical shaft motors. Obviously the motor and pump speeds must be mutually adapted and this requires care on the part of the pump manufacturers. Alternating current motors are most commonly used in small municipal plants and their speeds are fixed depending on the number of poles of the motor and the frequency of the alternating current. For the common frequency of 60 cyles the standard small motor speeds are 1800, 1200, 900, 600 and 450 revolutions per minute. In connection with air-lift pumps motors may be used to operate the air compressors.

Surface Pumping

For surface pumping displacement, centrifugal and rotary pumps are used. Until recently displacement pumps had the field pretty much to themselves. Because of lack of understanding of its characteristics, the centrifugual pump has gained, in some quarters, the undeserved reputation for trickiness. The modern centrifugal pump correctly applied is

really an extremely reliable piece of machinery because of its high speed and favorable operating characteristics is particularly well adapted to motor drive. Its efficiency is usually somewhat lower than that of well designed displacement pumps. In a line of modern pumps ranging in capacity from 200 to 2,000 gals. per minute at 100 ft. discharge head, the efficiency ranges from 60 to 77 per cent. These figures are much higher than those secured with some of the older designs.

The output rating of an electric motor is limited by the heating of the motor windings. The rating assigned by the manufacturer is that output which the motor can carry continuously without over heating the windings. Because of this heating limitation, some care must be taken in selecting a centrifugal pump which is to be mated to a motor.

If the head against which a centrifugal pump is discharging is gradually increased, the discharge lessens until finally at a head fixed by the design of the impeller, it ceases and the rotating part of the pump simply churns the water in the casing. Under these conditions that pump requires only a fraction of the power required when delivering rated discharge. The valve in the discharge line of such a pump may be closed, therefore, without endangering either the pump or the motor.

If now that head be slightly decreased the pump will start to discharge and the power required by it will increase. For a pump of suitable design for operation with an electric motor the curve showing the relation between head and rate of discharge should be comparatively flat until rated discharge is reached. Thereafter the head should decrease rapidly. Such a pump is said to have a drooping characteristic. As the power required to operate the pump decreases as the head decreases the possibility of seriously overloading the motor, in case of a break in the water main, is avoided.

As protection to the motor where displacement pumps are used, suitable safety valves must be provided in the discharge line to prevent the pressure from being built up to a dangerous value when the demand in the pump is low. Displacement pumps are not as well adapted to direct pumping as the centrifugal type is.

The motors best suited for pumping service are the three-phase, squirrel cage induction motors for alternating current and the shunt motor for direct current. The alternating current motor is extremely rugged, simple and reliable, has no moving electrical contacts and may be secured with moisture proof windings. Both types of motors and all well designed high speed centrifugal pumps are equipped with ring oilers and will run continuously for long periods with only occasional inspections.

In addition to type of pump the application engineer must know the required discharge, the total pumping head, the kind of electrical energy available, whether direct or alternating, and if the latter, the frequency. The total head is fixed by the suction lift, the pipe friction, and the discharge head. Working pressures vary widely in different towns. For ordinary service the common range is from 30 to 50 lbs. per sq. in., while for fire service, pressures ranging from 50 to 100 lbs. per sq. in., are in common use.

The following actual examples illustrate in a general way the motor application problem. The figures are of the pre-war period, the example chosen being considered rather more typical than one in which the present fluent cost and labor conditions would be involved.

Concrete Illustrations

A town of 2,500 population has a steam pumping plant which has been in service for 20 years and is now about ready for the scrap pile. The direct pumping system is employed and funds are not available for the erection of a standpipe or tank. Three-phase 220-volt, 60 cycle power of high reliability is available. The ordinary working pressure is 40 lbs. per sq. in., but for fire protection purposes, 65 lbs. per sq. in., with enough capacity behind it to furnish two 1⅛ in. nozzles is desired. At this pressure two such nozzles will discharge about 400 gals. per minute.

Meter readings of the domestic requirements were taken during two summer periods, one of 6 days in August, the other of 15 days in September. For the first period the following data were taken:

		Gallons per minute	
Day	Discharge in 24 hr. avg.	Day 6 a. m.-6 p. m.	Night 6 p. m.-6 a. m.
1	160	181	140
2	175	190	150
3	187	212	155
4	175	195	155
5	167	187	142
6	157	175	125
Average	170	190	144

The average for the second period was 168 gals. per minute. The maximum discharge noted was 240 gals. per minute. It was only of short duration. The suction lift and pipe friction were such that for ordinary pressure the total head was approximately 110 ft., and for the fire pressure 165 ft.

For ordinary service the data indicate that a 200 gals. per minute pump is large enough and for fire service a 500 gals. per minute pump. In case of fire the larger pump would be started and the smaller one shut down. Had it been a standpipe installation, a larger low head pump would have been advisable as it would have to run fewer hours per day to maintain the water level. Also, automatic starting and stopping would have been desirable. For the conditions in hand centrifugal pumps best fit the requirements and they were selected.

The sizes of motors necessary to drive these pumps may be calculated

$$\text{Hp} = \frac{\text{Gallons per minute} \times \text{total head}}{4000 \times \text{pump efficiency.}}$$

For the case in hand the figures are 9¼ and 31 hp. respectively. The nearest commercial motor sizes are 10 and 35 hp. and these were selected.

Costs

The estimated cost of changing to electrically driven pumps, including changes to the pumphouse and some suction line alterations was $3,000, the pumping units themselves costing $475 and $850 respectively. The cost of similar units today would be about twice that, the costs of a line of well designed modern centrifugal pumping units, capacities up to 2,000 gals. per minute, for 100 ft. head being given by

Cost=$850+$34 n where n=number of hundreds of gallons per minute rating

For 200 ft. heads the

Cost=$1600+$107 n

The pump costs alone can be figured from

Cost=$540+$7 n on 100 ft. heads

and Cost=$1200+$53 n for 200 ft. heads.

The fixed charges on the new installation at 15 per cent a year amount to $450 per annum. The salvage of the old steam plant actually decreased the investment a small amount, but this was not considered in the above estimate.

The estimated operating expenses of the new plant were $1500 per year. This included one sixth of the time of a water works employee who spent the rest of his time on other work. Energy for the operation of the pumps was obtainable at an average figure of 1.85 ct. per kilowatt-hour the actual rate being of the familiar sliding scale type. The estimated energy consumption per 1,000 gals. was 0.8 Kw.-hrs. and the energy cost 1.48 cts.

The average operating cost of the old steam plant for 3 years preceding the time in question was in round figures $2900 per year. Of this amount nearly 50 per cent, was fuel cost. The entire time of two men was necessary for the operation of the plant.

For the last year of steam operation the average fuel consumption was 14.7 lbs. of coal per 1,000 gals. The average fuel cost was 1.8 ct., and the average cost of attendance 1.27 ct. per 1,000 gals. With the present prices of fuel and labor the saving in operating expenses would be nearly double the $1400 per year indicated by the above figures.

Sanitation in Emergency Shipyards

By W. L. Stevenson, Late Sanitary Engineer, Department of Health and Sanitation, United States Shipping Board, Philadelphia, Pa.

The maintenance of a healthy and energetic force of workmen in the emergency shipyards was as essential to the shipbuilding program as the protection of the health of the boys who were being trained in our Army camps was to the success of our military plans.

But the shipyard worker was not subject to orders as men in the Army and Navy are, and besides the building of ships was done under contracts, most of which, especially those of early date, contained no sanitary requirements.

A Difficult Problem

When Lieutenant-Colonel Philip S. Doane was assigned by Surgeon General Gorgas, U. S. Army, to the Shipping Board to organize and be the Director of its Department of Health and Sanitation, he was therefore confronted with a very difficult problem.

The managers of the shipyards could see and understand that a well laid out yard, prompt delivery of materials, use of labor-saving devices and efficient methods of handling work were clearly connected with speed of production. But it was necessary in many cases to educate them to believe that the distribution of water by the common drinking cup, the exposure of excreta to flies, and the lack of adequate eating facilities were real menaces to the health of their workers and hence factors to be seriously reckoned with.

The splendid support given by the officials of the Emergency Fleet Corporation and the hearty co-operation so generously afforded by the civic and state health officials, together with the evident benefits to the shipyards of the work of the Department, are the main causes of the great success obtained by Colonel Doane in protecting the ship-workers against disease and maintaining them in a vigorous state.

During the early days most of the shipyards were in a state of construction for even the existing requisitioned yards were greatly enlarging their plants. The engineering side of the work was therefore more accentuated than is usual in public health work where maintenance of healthful conditions is the main purpose.

Medical Measures

It may be stated very briefly that the policies of the Department in connection with the medical side of the work included the physical examination of the workers, control of communicable diseases with especial attention to venereal diseases (if there was evidence of their prevalence), vaccination for smallpox and typhoid, provision for prompt treatment of wounds in first-aid stations, adequate medical and nursing staffs, and in the larger yards dispensaries or yard hospitals.

Influenza

When the influenza epidemic swept over the country the policy was to introduce in advance every safeguard to prevent its inroad into the yard rather than to await its prevalence and combat the scourge by curative measures. That these measures were successful is evidenced by the lower case-rate in many shipyards than in other industries in the adjoining territory.

Most of the Sanitary Engineering problems were closely related to the environment factors. Only a relatively few yards were located in towns or cities, while many of them were so situated that they were largely thrown on their own resources for many matters usually the function of a munipality to provide for industrial establishments.

Water Supply

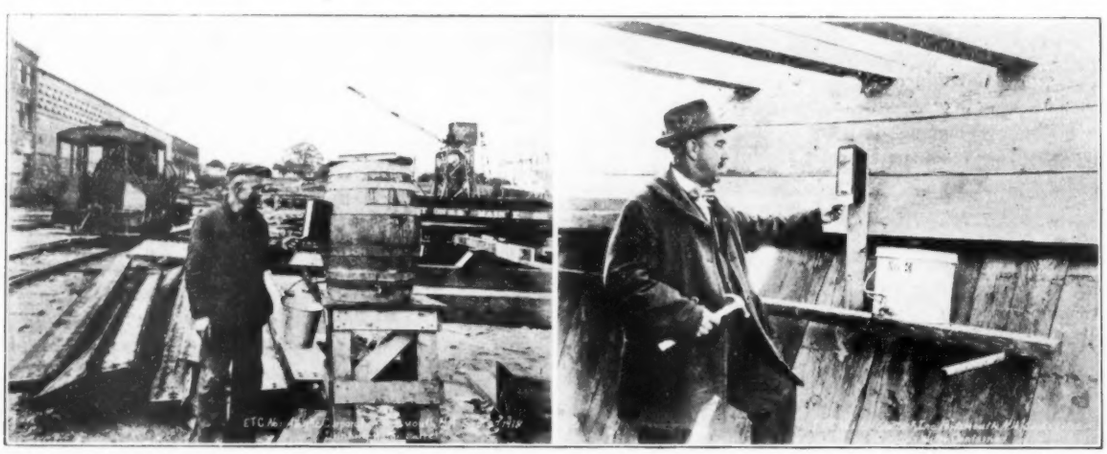
It was assumed as axiomatic that an ample supply of clean, pure water (cooled in summer), properly distributed throughout the shipyard for drinking and washing purposes, was absolutely essential to the maintenance of health among the workers. Wherever possible, safe water from an adjoining municipality or private water company was piped to the yard. If this was impracticable, efforts were made to obtain artesian water or some other safe underground supply. Through the good offices of the various state boards of health, the quality of the water was constantly watched, and sterilization urged if there was any suspicion of contamination.

Careful investigation was made to prevent the use of a supply other than of drinking water purity in washrooms, shower baths, or any other place where men should not but often do drink. It was recognized that a thirsty workman will drink "anything that is wet" despite all the warning notices posted to the contrary.

Efforts were made to obtain the distribution of water by pipes and bubbling drinking fountains preferably with inclined jets and having a housing to prevent the drinkers' lips touching the orifice.

In a number of Southern yards the water was cooled by passing it through coils in an ice box immediately adjacent to the fountain.

It was very difficult to avoid the use of the bucket and common dipper for the distribution of water in the hulls of the ships. The influenza epidemic afforded an opportunity, however, for the installation in many yards (not provided with a system of water pipes) of covered barrels with a spigot and a

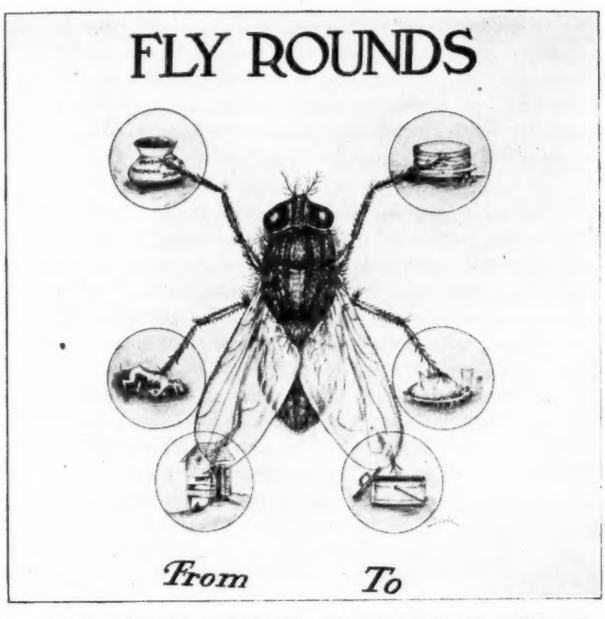


THE TWO METHODS OF DISTRIBUTING DRINKING WATER INTRODUCED DURING INFLUENZA EPIDEMIC INTO SHIPYARDS PREVIOUSLY USING BUCKETS AND COMMON DIPPERS. BARREL ON LEFT; CONTAINER ON RIGHT.

dispenser for flat-paper drinking cups attached and for use in the hulls of smaller metal-covered containers with the paper cup dispenser fastened to the side of the hull. These two methods were very reasonable in cost and proved to be convenient and satisfactory.

Fire Protection System Safeguards

Fire protection was of great importance in the shipyards and it was quite common to find two systems of water mains—one carrying water for industrial and fire-fighting purposes, and the other for drinking water. The fire mains were connected to emergency fire pumps, the suction to which was obtained from the nearby river or harbor, and hence frequently seriously contaminated. The two systems were sometimes found to be interconnected and the only safeguard a gate valve. Where fire protection did not absolutely demand the interconnection, steps were taken to make the two systems absolutely independent; but where the connection was necessary and could be accepted by the local health authorities having jurisdiction, a dual connection was permitted consisting of two



FLY POSTER USED IN SHIPYARDS BY DEPARTMENT OF HEALTH AND SANITATION, U. S. SHIPPING BOARD. IT MADE A STRONG IMPRESSION ON THE WORKERS.

check valves provided with three pressure gauges and two blowoffs for testing the tightness of the checks and also two gate valves to make possible examination and repairs to the check valves.

Collection and Disposal of Wastes

The proper collection and disposal of excreta in the shipyards were considered of almost equal importance to purity of water supply. Naturally in the haste of construction in the early days, the ordinary unscreened privy was commonly found. Another method was the so-called "drop toilet," which consisted of a sheltered seat over the water at the end of the ways.

It is very difficult if not impracticable to keep either of these forms clean, and an effort was made to have installed water closet fixtures connected to a sewer. Open-front seats were urged as a precaution against the transmission of venereal diseases.

Where it was necessary to permit the use of privies, considerable success was obtained in the prevention of odors by the use of a urinal trough which led to a separate excavation which was backfilled with broken stone or coarse gravel. This tended to keep the solid excreta drier than otherwise, and it was found that frequent application to the trench of dry earth also materially aided. Of course, these privies were thoroughly screened, ventilated, and had self-closing lids attached to the seats.

Washrooms

Washrooms, dressing rooms provided with lockers or other means for keeping the men's clothing clean and separated, and shower baths were deemed advisable and recommended, but it was realized, in consideration of the emergency nature of the work and the need for labor and materials, that these features were not of equal importance with water supplies and toilet facilities.

As a precaution against the danger of lead-poisoning, however, it was urged that painters should be provided with ample washing facilities. Troughs equipped with overhead spigots so that washing could be done with running water were preferred to the ordinary wash bowl with a stopper.

Fly and Mosquito Extermination

War was relentlessly waged against flies and mosquitoes first by measures to prevent breeding and secondly by screening.

Instructions were issued that manure from stables should either be removed at very frequent intervals and spread on fields in very thin layers or collected in fly-tight manure pits. Careful attention was given to see that all garbage was kept in covered, impervious containers and promptly removed from the premises.

In cases where flies were bred in the neighborhood of the shipyard and hence not under control of the Shipping Board, the good offices of the local or state health board were invoked and the nuisance was practically always abated or greatly minimized through their powers.

Several very large and comprehensive projects were inaugurated toward mosquito control by ditching, drainage works, and oiling. The largest project was at Philadelphia, where 10,000 acres of land contiguous to the large Hog Island shipyard were successfully drained and oiled under the general supervision of the Pennsylvania Department of Health.

In the South especially attention was given to complete screening of all living quarters to control malaria, but throughout the entire country very creditable results were obtained from efforts to secure screening against flies in eating places and food-handling establishments.

It was deemed as essential that the workers should have wholesome, clean food to eat as it is to burn proper fuel in a boiler if it is expected to develop power. Some shipyards maintained their own restaurants, others granted the privilege to someone to operate lunchrooms in the yards, while other yards lacked any eating facilities inside the property and depended upon the men going home, bringing their lunches, or obtaining it at eating places outside the gates. This made control over the eating facilities quite varied. Inspections were regularly made to obtain, where possible, the use of Government inspected meats, pasteurized milk, proper refrigeration of perishable foodstuffs and cleanliness of kitchens. Strenuous efforts were made to secure the medical inspection of all food-handlers.

Where insanitary eating facilities existed outside the shipyard gates, the remedy was found in the co-operation of the local health authorities having jurisdiction.

Several cities passed ordinances to clothe their health departments with necessary power to control in very splendid fashion the eating places patronized by the shipyard workers.

In common with many other war-time public health activities, it is believed that the work of the Health Department of the Shipping Board not only helped in speeding up the building of the yards and ships, but also served as a great educational movement to the host of workers who must have carried many of the lessons in cleanliness and personal hygiene learned in the shipyard to their homes, which will lift their homes to a higher plane of living.

American Good Roads Congress and American Road Builders' Association Convention

The Ninth American Good Roads Congress and the Sixteenth Annual Convention of the American Road Builders' Association will be held at the Hotel McAlpin, Broadway and 34th street, New York City, February 25 to 28, 1919.

Many problems of the most vital interest and importance are at the present time confronting the road builders of the country. It is proposed, therefore, to bring together those most prominently identified with highway construction, transportation and maintenance for the purpose of considering the questions of the hour.

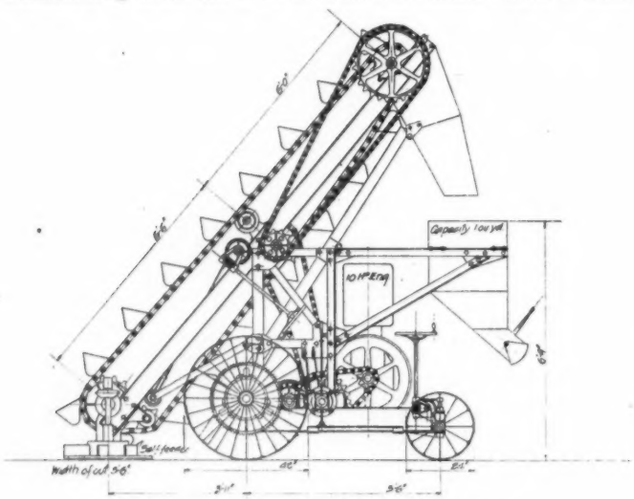
The program which is now being prepared for the eight sessions of the congress will be devoted to the consideration of highway transportation and the administration, financing, construction and maintenance of national, state, county and municipal highways. Papers by prominent highway authorities and reports on live topics by several committees will be presented for discussion. The general plan contemplates devoting February 25 and 26 to the presentation and discussion of papers and February 27 and 28 for the consideration of reports to be submitted by several committees. The business session of the association will be held on the afternoon of February 28, and the annual banquet on the evening of the 26th or 27th. It is proposed to show motion pictures pertaining to highways on two evenings during the congress.

Next year it is proposed to hold in connection with the convention the most complete and comprehensive exhibit of road machinery, equipment and materials ever seen. At the time, however, it was decided to hold this year's convention in New York City, the war was still in progress and it was felt to be out of the question to have an exhibition on anything approaching a large scale. It was therefore decided to limit this feature to the facilities afforded in the Winter Garden on the top floor of the Hotel McAlpin.

A Self-Feeding Loader

The Austin Self Feeding Loader, here illustrated, is a new development in the multiple bucket type of loader. It has a patented self-feeding device which increases the economy of operation. This device enables the owner to dispense with the two men usually employed to feed buckets on machines of this general type.

The feeding device consists of two eccentrically mounted discs that continually sweep through the pile of material to be loaded with a range of cut 5 ft. 6 ins. wide. Mounted over these discs are a series of curved feeding blades that carry the material from the pile to the bucket line automatically withdrawing from the load so that the buckets have a clear sweep across the discs for loading. These feeding blades cut through the material pile continuously forcing it into the bucket path.



THE AUSTIN SELF-FEEDING LOADER.

The elevator proper is arranged for vertical movement both for cutter adjustments and folding back in traveling for shipping clearances. The power plant consists of a 10-h.p engine hopper cooled type and operating machinery consists of a direct drive chain and gear transmission, giving elevator operation, and two speed and reverse traction. The low or feeding speed is provided for use under working conditions while the high is for traveling.

Make Good on Pavement Construction to Avoid Necessity of Making Excuses for Failure

By F. A. Churchill, Conneaut, Ohio

Finding excuses for pavements which go bad is an easy job, but at best it is satisfactory only to the discoverer. Engineers seldom have to go far to discover the cause of the failure of a pavement which is constructed of materials which ought to give good results. It may be inadequate drainage, or a soft sub-grade, or an uneven foundation, or poor grouting, or delay in getting filler in place, or negligence in rolling to an even surface, or any one of a dozen causes of defects in pavements; but while the cause may be understood by an engineer, the wayfaring man, knowing nothing about such matters, condemns the type of pavement as a failure.

Attitude of Average Citizen

The average person has no technical knowledge of road building. He judges of merit solely by what he sees. In his mind there are several types of pavement, but he allows for no variations in type. In his estimation a type is either good or bad, and he judges by superficial indications, regardless of loose specifications, improper designs or dishonest or ignorant constructive work.

Builders of roads should take into account the mental attitude and inherent rights of the average citizen whose money is spent in building roads. It is not enough that preventable causes of failure can be determined after the failure. It is the duty of road builders to learn how to overcome destructive causes, and then to adopt preventive measures.

There appears to be too much generalizing in road building and too little flexibility in designing.

Spongy Spots in Subgrade

Spongy spots or stretches may be encountered for short distances in a generally solid subgrade. In such places extraordinary care should be taken to keep moisture out of the subgrade, and often it is desirable to increase the depth of artificial foundations at such places in order to give the pavement a beam strength greater there than is required elsewhere.

Depth of Foundation Should Vary

The practice of designing a brick pavement with a uniform depth of foundation for all kinds of sub-grade is the parent of evil and the source of regret. If it be good engineering practice to design pavements for the traffic they must bear, it ought to be good practice so to design a pavement as to equalize its resistance to load and vibration stresses at all points. It is obvious that a foundation adequate for a firm and dry sub-grade may not be sufficient for a subgrade that by reason of quicksand, sponginess or excessive moisture gives little support to the foundation. It is a matter of general knowledge that few highways of any considerable length have the same kind of sub-grade throughout. This fact should be given due consideration in designing road improvements; but in practice it is customary to design for a highway the same depth of foundation for all kinds of sub-grade conditions.

An Example of Faulty Design

The folly of such design was exemplified on the Cleveland, Akron road, over which an enormous freight traffic passes.

This road, 42 miles long, was built of brick with the exception of about four miles of asphaltic concrete. About two miles of the brick section was built over marshy ground, with no greater depth of foundation there than on the firm, dry section. The result was that in the spring the sub-grade for the two miles became mushy; no support was afforded the pavement, and the 12-ton and 15-ton trucks broke through the pavement and foundation, and destroyed the beam. The asphaltic-concrete section also was broken up; but the 36 miles of brick on the better soil stood up well. A 5-inch concrete foundation was laid throughout. If the two miles of road over the low ground had been provided with a foundation deep enough to assure a beam strength sufficient to bear the truck traffic, it had been wiser and cheaper in the long run.

In some sections, especially in Northern Ohio, pockets of quicksand give considerable trouble to road builders; but designs for road improvements rarely take these weak areas into consideration. Specifications require uniform foundation for stable sub-grade and for quicksand sub-grade.

Cheap Pavements Please Taxpayers Only Temporarily

The reason for this unwise practice is not far to seek. Minimizing original cost in order to reconcile taxpayers to road improvement is the prime reason for specifying a foundation for an entire highway of no greater strength than is required for average conditions. It would be sound practice to vary the depths of foundations to suit soil conditions. That might be done in many instances without materially increasing the cost. If low, wet soil required 8 ins. of concrete foundation under the brick, high, dry, compact soil might not require more than 3 ins. of concrete foundation, or, at the most, 4 ins. of concrete for heavy traffic. As a rule, the low places are comparatively few, so that by striking an average the cubic yards of foundation would not be in excess of the cubic yardage usually specified under the uniform system.

The suggested plan would involve more detailed survey of the route than is usual, and more careful preparation of plans, but it would avert some of the major troubles which ordinary practice entails.

Give More Attention to Drainage

In connection with this provision for weaknesses in brick pavements, greater attention to drainage is advisable. Sometimes drainage in a swampy section is not a problem the road engineer can solve; it may involve a system of drainage of a large area, and in that case it is a duty for the county or the state to perform.

The gist of the matter is this: Pavements should be so designed and constructed as to reduce hazards to the possible minimum.

Engineers and others in authority owe that kind of service to the taxpayers. It requires some moral courage, and oftttimes it involves some risk of popularity, to insist upon having things done the right way even at greater cost than is usual; but engineers and other officials must have a high standard of official responsibility if public money is not to be squandered on poorly constructed roads.

It is a fact to which many can testify that although the taxpayers may grumble about the cost of a public improvement, if an equivalent for money expended is found in permanancy and in satisfactory service given, the taxpayers eventually endorse the work and recognize the ability and integrity of the workmen.

Lessons Taught by Road Building Experience in Florida

By G. Robert Ramsey, Assoc. Mem. Am. Soc. C. E., Consulting Engineer, Orlando and Tallahassee, Fla.

Florida has spent, relatively, more money in the construction of roads and improved highways than perhaps any other state in the Union when productive area, the assessed valuations, the population and, last but not least, its distance from the manufacturing centers, are taken into consideration.

Early Efforts

Florida road building has gone through all the stages from the County Commissioner building dirt roads in his own district, with an occasional attempt at some other kind, to the County Superintendent with the aid of the County Surveyor whose duties up to this time had beenlargely confined to running section lines on Clay roads.

All this resulted in a certain amount of education for the officials engaged and in a short time they were inspired road builders. The taxpayer, however, had full knowledge of the cost.

Quality Sacrificed to Quantity

The promoter has also been busy and there are many miles of road that have been built, as the result of his propaganda that are pleasing to the eye when first laid but which time will prove, I fear, to have been an expensive investment for the taxpayer, even when the first cost is given full consideration. Fortunately, perhaps, many of those who were taxpayers when the roads were promoted will not be taxpayers when the final settlement is made.

The slogan has been "So many miles for so much money" and quality has been sacrificed to quantity. This does not apply to any particular type of road but to all of them. Let us briefly review the results.

Mistakes Made on Brick Highway Construction

Many miles of brick highway have been built in Florida. Unfortunately many of these roads are only 9 ft. in width. For economical reasons the brick have been laid flat and a sand filler used. No base other than the sand has been used.

Even with the utmost care being exercised in the puddling and rolling of the base, and close attention being given to the use of templates to strike off the surplus material after the rolling has been completed, soft places will develop that cause a settlement in the wearing surface. This is not all, for in many cases drainage is but a secondary consideration. Assuming that proper attention has been given this latter point, it is not long after the contractor and the engineer leave the work before the side ditches are filled up, with the result that the water table is raised and in time seeps under the brick.

Traffic then finds the soft places due to the fact that because of the narrowness of the road it is confined to a given tread and the constant pounding in the same place causes a settlement in the brick to a greater or less degree, dependent upon the solidity of the foundation and the duration of the period in which the water remains in contact with the bottom of the brick. The wearing surface remains however, and at some future day may be taken up and relaid.

Good Results with Cement Grout Filler

Satisfactory results have been obtained on a sand foundation when the brick have been properly grouted with cement. Orange County built about 10 miles of the latter type in 1914 and Seminole County completed 27 miles in 1917. These roads are withstanding the present traffic and it is believed that they will remain in good condition under considerably heavier traffic than they are now subjected to. For cheap construction the grouted brick road is the most economical for Florida for it is the only road that can be laid with any assurance of durability without a prepared foundation.

Concrete Roads

Concrete roads have been laid in Florida with variable results. It is a well established fact that there are no aggregates indigenous to the state that are entirely satisfactory.

It is not my intention to imply that there are no aggregates in the state that can be used for concrete, such is not the case, but I do mean to say that there is no material that will make a satisfactory wearing surface.

The necessity for a base in all types of construction for heavy traffic is making itself felt and it will be but a question

of time when officials who have road matters under consideration will be content with less mileage and roads of better and more lasting construction. When this time comes the limestones and flints of Florida will come into their own in the construction of the base.

There are localities in Florida where concrete roads can be built well and at a reasonable cost even with the rock for the wearing surface imported and with the further knowledge that within a certain time they will have to be given a carpet coat of tar or asphalt.

Sand-Asphalt Roads

The sand asphalt roads of Florida have attracted the attention of the tourist because of their seeming smoothness when first laid. An analysis of the construction methods will, I think, show the inadequacy of this type of construction, particularly under the specifications that have been used to date.

The usual method pursued is to specify a clay base from 4 to 6 ins. in depth with a wearing surface of from and 1½ to 2 ins., more often the former.

Construction methods vary but slightly and the usual procedure is to spread the clay and depend in a large measure for compaction by traffic. The assistance or rains is not always wished but at times they contribute toward the thorough soaking of the road which later dries out and leaves deep ruts.

Prior to the laying of the top a road machine is sent over the work just ahead and the ruts are filled in with varying size chunks. Then the roller goes over it, rides the edges of the ruts and leaves unconsolidated parts which later on will be softened up by water from the bottom with the inevitable result that the road will show just where those ruts were.

Then the hot stuff is hauled long distances, often as far as four miles, and this in uncovered bodies. Obviously one of two things must happen or are likely to happen. They must heat the sand-asphalt to a point dangerously near burning, at the plant, to get it to its destination with the proper temperature, or it doesn't reach the job at the proper heat.

As a result of these conditions many of the roads would indicate considerable age were one to judge from the number of patches, when in reality the patching is done before the road is finally accepted, little or none is done afterward until such time as the road becomes impassable.

What is true of other types of road, insofar as ditches and drainage is concerned, is true here, with the well known results from the effect of moisture on bituminous pavements.

Good Roads Coming

Florida has come to the realization of what her road systems mean to her and the roads that have been built are but the forerunners of what is to come. The road of the future will be better and of sufficient width to permit of the passing of two vehicles.

Licensed Engineers

In 1915 the Legislature recognized the growing sentiment for improved roads and created the Road Department of the state. Further recognition was taken of the fact that incompetent engineering was as responsible for poor roads as were the much maligned contractors, hence they passed a law in 1917 creating the Engineers' Examining Board. It now is necessary for an engineer who wishes to practice his profession in the state to pass the examination prescribed by this board before he can do so.

Inestimable good will come from both these laws when the county officials and the people generally realize that it is not the intent in the case of the one to usurp any of the prerogatives of the county officials, and that of the other it is the intent to protect the interests of the taxpayer insofar as they can be protected by insisting upon proper engineering supervision. Unfortunately the latter law is not broad enough in scope to prevent the operations of the combination engineering and contracting firms with their guaranteed estimates.

Old and New Style Specifications

Under old conditions the contractor was at a loss to know how to bid on work for he had the influence of rival promoters, the inexperienced engineer and his personality, as well as contradictory specifications to bid against.

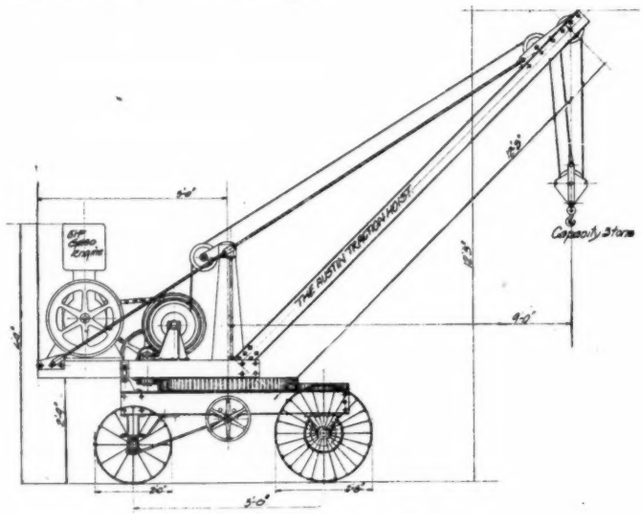
In many cases when the local engineer wrote his own specifications the result was a compilation of the most drastic points culled from specifications from all over the country without regard to local conditions and without a thought as to their possible legal interpretation.

All these conditions have tended to create discord and to discredit the engineer and the contractor as well. Be it said for the average contractor, however, that when he thinks that the engineer is conversant with the work that he is trying to handle he will as a rule meet him half way.

If the laws that have been passed are allowed to work out as they are intended to work, the State Highway Department, with Mr. W. F. Cocke at its head, will be of vast assistance to the counties of the state and there can be no question that the thoroughly competent engineers of the state, who are in private practice, will cooperate with him. Uniform specifications will be the rule, not the exception, and a contractor will be able to bid on specifications that he knows are capable of but one interpretation, he will not have to allow for the personality of the engineer, he will get fair prices for his work, and there will be more general accord between engineer and contractor.

The Austin Power Hoist

The Austin power hoist is portable. Because of its diverse utility it will be of real value to contractors. It is equipped to hoist and carry, under its own power, a load of 3 tons at a 9-ft. radius. The power plant consists of a hopper cooled gasoline engine with friction clutch controls for hoisting, swinging and traveling.



THE AUSTIN POWER HOIST.

It will be found especially useful on sewer construction, building erection, concrete paving, etc., for loading and unloading and the general handling of pipe, structural steel members, concrete carts, cars, etc. It is also useful for pulling sheet piling, for lifting excavation tubs and buckets, etc. The machine is illustrated herewith.

Rate Adjustment, Valuations, and Some of the Problems Incident Thereto

By C. M. Garland, Consulting Engineer, First National Bank Bldg., Chicago

In the operation and management of public utilities, the time has past when the management may expect to make large returns on the actual investment or medium returns on a

fictitiously large investment. The general trend of public opinion is to the effect that a public utility must first provide satisfactory service: Second efficient service, and third: That it must be allowed to make a reasonable return on the actual investment which should to all intents and purposes be a guaranteed return.

The matter of the satisfaction of the service may be left to the judgment of the public. In matters of this kind where no intricate reasoning is required, the judgment of the majority while it may be harsh is more than likely to be just. When it comes to the question of efficiency in the rendering of the service, which involves a knowledge of the details entering into the cost, the judgment of the majority is more than likely to be unjust.

Comparison of Rates

This question of the efficiency in the rendering of the service, which directly affects the cost of the service and consequently the rate to the public and the return on the investment, is one of the most difficult problems to solve satisfactorily to all concerned in the adjustment of rates. Invariably where an increase in rate is asked for by a public utility, one side or the other starts in to compare the rate of the local utility with the rate of one or more utilities in the immediate vicinity. Comparisons of this nature if not made by disinterested experts invariably work injustice to one side or the other.

Suppose for example, that the local company asks for an increase in rate and contends that this rate should be given because they are not showing a satisfactory return on their investment; this they follow up with a statement of their costs, etc., and to clinch the argument point out that the Power Companies in adjacent cities have a much higher rate and consequently it is obvious to any one that their rate should be increased.

This line of reasoning would undoubtedly appeal to the majority of the people particularly if the company had been sufficiently fortunate as to have rendered a highly satisfactory service and consequently were in favor with the people. This argument may however, be entirely fallacious and the granting of the increase in rate may work an injustice to the people. In the first place the local company may be over capitalized which would account for the low return on the investment. Again it may be, a much larger plant, or it may be serving a much more densely populated territory, or it may be serving a manufacturing community and have a much higher load factor or it may be a much more modern plant. In fact, there may be a dozen or more reasons why the local company can make its power cheaper than the companies in adjacent territories. The people served by the local company should therefore be entitled to a lower rate than the people served by the near-by plants.

Local Conditions Govern Rates

On the other hand, it might be equally unjust for the public served by the plants in the adjacent communities to say that these plants should sell power at the same rate as the local plant referred to. The point to all this is, that a change in rate must be based entirely upon the conditions existing in and about the local plant and not upon the rate made by some foreign plant. A community must pay a rate based solely upon the conditions existing in that community.

Penalty for Inefficiency

Another point that arises in connection with this question of efficiency, is, to what extent should a company be penalized for its own inefficiency and short sightedness? It is obvious that the public should not be made to pay for all kinds of inefficiency on the part of the company. Where the inefficiency lies in the operating and not in the equipment, and where the extent of the inefficiency is sufficient to show a proper return on the investment without an increase in rate, providing this inefficiency is eliminated, no increase in rate should be granted. If the improved efficiency is not sufficient to show a proper return, an increase in rate should be granted.

Where the inefficiency lies in the equipment the solution is not so simple. The faulty equipment may be due to mistakes in selection, to the company's lack of foresight in buying, or to the use of equipment which has outlived its period of usefulness. It has been the writer's custom in the first two cases to let the company stand part of the loss due to its errors and the public stand the remainder. This might not seem on first thought to be fair to the public, yet it must be understood that there is always a possibility of error in the selection of equipment and that the operating economy is not always as great as expected.

Where the company is permitted only a reasonable return on the investment, it is fair that the public should share in the hazards of the business.

War Hits Water Gas Companies

An interesting example in this connection is that of the Gas Companies who found themselves equipped with a large proportion of water gas apparatus when the war came on. The cost of enriched oil jumped from around 3½ cents a gallon to as high as 10 cents and coke in about the same ratio. This raised the cost of delivering water gas to the holder from about 30 cents per M, the pre-war cost, to something like 60 cents per M. Coal gas however, could be produced even under war conditions at about 35 cents per M delivered to the holder.

The use of carburetted water gas equipment has been common in the past so that it could not be said that these companies were at great fault, yet they found themselves greatly handicapped by the water gas equipment. They could not hope to compete with coal gas so that they were under the necessity of asking for a large increase in rate, much larger than was demanded by the coal gas companies operating possibly in adjacent communities. In cases of this kind the companies operating the water gas equipment were entitled to a sufficient increase in rate to allow them to do business and show a moderate return on their investment.

Depreciation and Obsolescence

Where out of date equipment is being used and poor economy results in a demand for an increase in rate, or where the company has been making a fair return on the investment with this equipment, but changes in market conditions have lowered this return and an increase in rate is necessary, the company should clearly replace the out of date equipment. If the company has been properly managed there should be a sufficient reserve to replace this depreciated equipment. Unfortunately there are very few plants that have maintained any adequate reserve for depreciation or absolescence. During the past few years many of these plants have found their net returns cut down to such an extent by increases in cost of labor and materials that they could scarcely pay the interest on their indebtedness. If they had had modern equipment there would have been no occasion for their financial embarrassment. In such instances the community has been forced to grant a temporary rate increase sufficient to let the company pay the interest on its obligations and sufficient additional to enable it to raise sufficient money to replace the depreciated equipment.

Over-Capitalization

The failure to provide an adequate reserve fund for depreciation is really a means for the bringing about of an over capitalization. For example, suppose a gas company owns a retort house originally costing $250,000, this equipment has been in service for a number of years and is now out of date, inefficient, and in such a poor state of repair as to make replacement neccesary. The company has carried no reserve for depreciation to speak of. When the proper time arrives it states that it requires money for extensions and borrows $500,000, half of which is required to replace the old retort house and the balance for actual extensions necessary to meet increased capacity demand. The company still carries the original investment of $250,000 for the old retort house and $500,000

addition for the new extension. Obviously the company has been over capitalized by $250,000.

In cases of this kind where no reserve is maintained the stockholders receive not only their dividends on the investment, but also their principal in the form of dividends. It is clearly the duty of the engineer in making his report to charge off the depreciated equipment.

After the question relative to the efficiency in operation come the questions of the value of the property and as to what may be considered a reasonable return on the investment.

Valuation

The question of valuation involving such items as depreciation, appreciation, obsolescence, going value, franchise value, organization expenses, etc., is one promoting endless argument and ultimately must be settled by compromise.

The items of depreciation, appreciation, and obsolescence can be very closely estimated for different parts of the plant so that it is entirely practical to set aside an adequate reserve fund for the purpose of replacing depreciated equipment. This seems to be the only practical means of preventing over capitalization of an enterprise which is required to operate with a reasonable return on the investment.

Rate of Return and Going Value

In the case of a Public Utility permitted to make only a fair return on the investment, say 6 or 7 per cent. for dividends, and from 2 to 4 per cent. for a depreciation reserve, it must be held that such an institution has no, "going value." Such items as advertising, and the promotion of sales, should be considered as operating expenses and not as a part of the capital charge. The situation is entirely different from that of an industrial undertaking, whereby money spent in advertising and in the promotion of sales has resulted in the building up of a business paying large returns on the investment. In many instances Public Utilities have practically a monopoly of their business. If the original company is therefore permitted to pay only a reasonable return on the actual investment, and this company sold out and required its successor to pay any appreciable amount as a "going value," the successor would either have to be content with a return on the investment less than what was considered reasonable for the original company, or the community must grant an increase in rate sufficient to pay the interest on this, "going value." Where the return on the investment approaches the legal rate of interest assuming that the management is efficient, there is no "going value," to sell.

Franchise

In the case of the franchise, if this has been granted to the original company without payment of any kind, and solely with the understanding that the company must be in position to supply power, gas, or water as the community requires, clearly no capital charge should be allowed. This is true even though the original company has sold out its rights and obtained from its successor a large amount for the franchise. If a value were allowed for the franchise in the valuation of the property of the successor, the public would be charging itself for something which it originally gave away. The conditions are different, however, where the company has paid the community for the franchise in any way whatsoever. In cases of this kind, a value must be allowed for the franchise in arriving at the value of the property.

Such items as organization expenses in reasonable amounts and interest on the investment during construction are true capital charges and should be entered as such.

For the sake of a rate adjustment a so-called detailed appraisal involving the appraisal of every bolt and nut around the plant is not required. As a matter of fact, such appraisals are never required except for the purpose of meeting the requirements of legal red tape.

The High Cost of Appraisals

An illustration of what a detailed appraisal can be made to run into is shown by the figures recently published for the cost of the appraisal of the properties of the Peoples Gas, Light & Coke Company made by the City of Chicago.

According to these figures this appraisal has cost the City about $246,000, and the work is not yet complete. An appraisal of these properties is without doubt a large undertaking, but $46,000 is sufficient to make an appraisal as accurate as an appraisal can be made.

Large volumes of figures covering every item in the plant may indicate a very high degree of accuracy to the legal or lay mind. It is quite likely, however, that these figures in so far as the total value of the plant is concerned are absurdities. Unless the actual cost figures are available, the appraisal of any plant is only an estimate. Every detailed item in the plant from the nails in the shingles up may be accounted for and appraised with great exactness; but when it comes to the question of labor and the expenses of construction errors of 25 or 50 per cent. are quite likely. Large errors are likely also in estimating the organization expenses, and the value of real estate.

The decision as to whether the valuation of the plant shall be based on the actual construction cost, the reproduction value today, or the average reproduction value for the last ten years, again raises a question as to the value of the detailed appraisal.

Where the original plant costs of a property are not available, a careful appraisal should be made. And after this, the company should be required to bring this appraisal to date at the end of each year.

The return on the investment should be such as to permit of the paying of dividends equivalent to 6 or 7 per cent. on the investment, plus from 2 to 4 per cent. for a depreciation reserve. This return should be practically guaranteed to the company by the community which it serves so long as the company is efficiently managed and operated. In times like the present, where prices are rapidly fluctuating, thereby varying the return on the investment, there should be some automatic arrangement for the adjustment of rates in accordance with the net earnings so that the community will not be burdened by expensive rate investigations and the activities of the company curtailed by the fear of a deficit in their working capital.

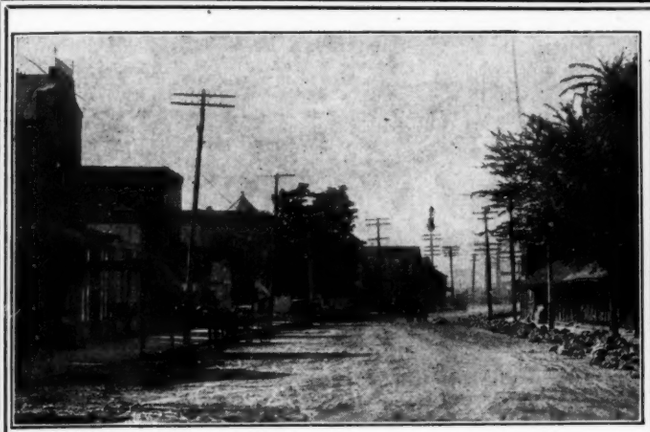
Proposed Eighteenth Street Bridge, Des Moines, Ia.

K. C. Kastberg, city engineer of Des Moines, states that the present 18th street bridge in that city is about 25 years old and has been badly neglected. Traffic conditions at the time the bridge was built were very different from those now obtaining. At the present time there are traffic restrictions on this bridge.

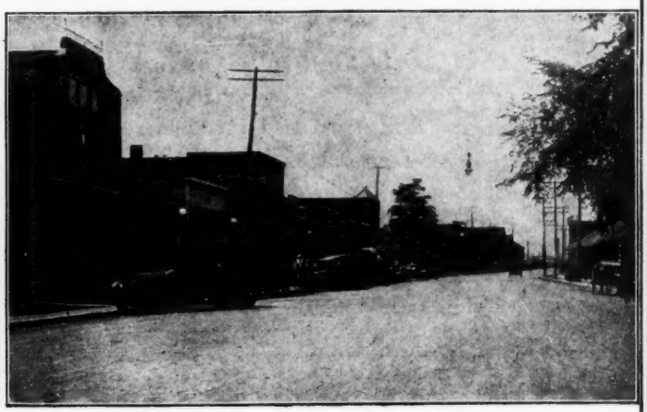
Ten and 12 ton loads have badly stressed the trusses in the old bridge. The floor wears out every 12 to 18 months and this costs the city yearly $3,000 to $4,000 to maintain.

Interesting points of design have arisen, the location has been discussed, and at a recent conference it was partially planned to build the new structure on the site of the old one and to erect a temporary one to take care of traffic during construction. The bridge will be about 1,000 ft. long and will be built high enough to afford head room for the railroad tracks. The north end will probably be of three-span deck girder construction and the balance of arch design with open spandrels.

The roadway will undoubtedly be built wide enough to provide room for street car tracks since the south side is developing to such an extent that it will soon require a car line there. The structure will cost in the neighborhood of $300,000 to $350,000. The Town Planning Committee is somewhat optimistic in planning what may occur in this district. Such problems as diverting the Raccoon River and straightening bad railroad curves may involve the expenditure of four to four and one-half million dollars in developing this district.



Before Tarvia was applied—*Above illustration shows the dusty and worn-out condition of Sinsinawa Avenue, East Dubuque, Ill., in 1915*



After Tarvia was applied—*The same view of Sinsinawa Avenue taken three years after Tarvia made it traffic-proof, dustless, and free from mud.*

Tarvia

Preserves Roads
Prevents Dust—

How To Make Bad Roads GOOD

THE road authorities in this instance had been trying to make plain macadam serve their purpose under modern traffic and the attempt failed as all such attempts fail, for *plain* macadam was never intended to withstand any such vehicle as the automobile.

So, when they resurfaced the road in 1915, they did it in a different way. Instead ot laying a new surface of hard, dry, brittle macadam which pulverizes readily under the swift motor-driven wheels, they laid *tarviated* macadam.

The broken stone was spread over the old road-bed, partially compacted under a roller, and then hot "Tarvia-X" sprayed upon the road, filling the interstices so as to inclose the stones in a tough, semi-plastic matrix of Tarvia.

Then there was a layer of finer stone and more "Tarvia-X" and a final surface coat of fine-stone screenings well rolled in.

The new surface is more than adequate to withstand the traffic. It is not wasting away as the old macadam did and the savings in maintenance will more than make up for the cost of the Tarvia.

Meanwhile the citizens of East Dubuque have secured a street that is smooth, clean, dustless and automobile-proof.

Look at the pictures and consider which road you would rather have in your town, *especially as the poor road costs more in the end than the good one!*

Special Service Department

This company has a corps of trained engineers and chemists who have given years of study to modern road problems. The advice of these men may be had for the asking by any one interested. If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will be given prompt attention.

Write for illustrated booklet and further information

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CONTRACTS AWARDED

ROADS AND STREETS.

Ala., Anniston—Nixon Transfer & Coal Co., awarded contract by Calhoun Co. to repair and improve 5-mile road, at $20,000.

Ark., Little Rock—Healy Constr. Co., Grady, Ark., awarded contract for bldg. road of native grave. Sevier county line by way of Dierks to Pike County line; abt. 18 miles; Howard County, at $146,560.

Cal., Long Beach—Fairchild-Gilmore-Wilton Co., Pacific Electric Bldg., Los Angeles, awarded contract for construction 4-in. concrete pavement with asph. macadam surface in alley extending north and south through block bounded by Anaheim and 14th St., and Elm and Linden Aves., at 16c per sq. ft.

Cal., Los Angeles—E. Schelling, 4316 So. Figueroa street, awarded contr. for grading and oiling Fountain avenue betw. Sanborn avenue and Bates avenue in the Fountain and Myra Avenues improvement district, at $11,071.

Cal., Los Angeles—M. S. Cummings, 1302 West 22nd St., awarded contr. for improvement of Sherman Drive from its southerly terminus to Pico street and portions of other streets in West Boulevard Impvt. District, at $27,777; Fairchild-Gilmore-Wilton Co., Pacific Electric Bldg., awarded contr. for grading, paving, constructing cement curb, walks, gutter, storm drains and sanitary sewers in Second street betw. Harbor Blvd. and Pacific avenue and portions of other streets in Second Street Impvt. Distr., San Pedro, at $394,663.

Cal., Porterville—The Worswick Street Paving Co., Fresno, awarded contr. for grading and paving with 5-in. conc. base and 1½-in. Warrenite wearing surface; also constructing corrugated iron culverts in Sunnyside Ave., Putnam Ave., Main Street and Olive Street, at $107,664.

Cal., San Francisco—Blanchard, Brown & Co., awarded contract by Bd. of Public Works, for paving St. Francis Circle and Sloat Blvd., $22,000.

Cal., Stockton—Wm. Moreing, 232 West Vine St., City, awarded contract for paving Yosemite Ave., to point near French Camp, at approx, $40,000.

Cal., Visalia—J. W. Lovelace, Visalia, awarded contract for improving 8 miles of Dry Creek-Quail Flat road, at 12,887; A. F. Schafer, Bakersfield awarded contr. for excavating and laying conc. paving on 6½ miles Porterville-Woodville division of county hwy., extending from Porterville to Poplar, at 50c per cu. yd. for excav., and $4.69 cu. yd. for laying pavement.

Cal., Visalia—Concrete Pipe & Construction Co., Porterville, awarded contract for grading and paving 1-⅛ miles of Lindsay-South division of the permanent county hwy. system of Tulare county at 80c cu. yd. for grading and $4.50 cu. yd for conc. paving; county to furnish materials.

D. C., Washington—Geo. B. Mullen & Co., 1751 A St., SE., awarded contr. for grading around Arlington Memorial Amphitheatre, Arlington National Cemetery, at $18,000.

Fla., Fort Pierce—D. T. McCarty & C. S. Sullivan, awarded contr. for 4 mi. of road, at about $31,000.

Ga., Macon—T. J. Lowe, Macon, awarded contr. by city for paving roads during 1919, at abt. $0.15½ per sq. ft.

Ga., Summerville—It is planned to construct by day-labor Georgia-Alabama Hwy., in Chattanooga County, Est. cost $90,000.

Ill., Belleville—Jno. J. Keeley Bros., East St. Louis, awarded contr. for road in Belleville, at $60,000.

Ill., Lincoln—G. K. Rhodes, awarded contract for paving in various streets at $75,000.

Ill., Milleyville—Independent Constr. Co., 304 Lane Bldg., Davenport, Ia., award. contr. for paving and drainage, at $65,000.

Ill., Peoria—Keokuk Quarry & Constr. Co., Keokuk, Iowa, awarded contract at $66,000 for paving 2½ miles in Peoria, Peoria County.

Ind., Decatur—Smith & Maltry, Breme, Ind., awarded contr. for constr. of 2 macad. roads in Washington and Wabash Twps., including grading and crushtone stone, at $6,375.

Ind., Delphi—Ross, Barber, Young, America, Ind., awarded contr. for constructing gravel road in Democrat Twp., Carroll County, at $7,177.

Ind., Paoli—Jas. Wilson, City, awarded contr. for constructing a 5,610 ft. road in Paoli Twp., including grading, constructing one brdg., and 4 culverts, at $3,440.

Ind., Portland—S. P. Beard, award. contr. for grading and paving with brick, at $27,-300.

Ind., Terre Haute—Lane Bros., Rockville, awarded contr. by Comrs. Vigo Co., for grading 1.1 miles Ft. Harrison Rd., 20 ft. wide brk. wearing surface and grout filler on 4-in. conc. base, at abt. $37,500.

Kans., Topeka—McCoy & Taylor, M. A. Ackerman, Salina and Stanley & Mackey, awarded contracts for 27½ miles monolithic brick pavement constr., in Barton County, at total expendt. of $1,452,500, or $53,000 a mile.

Kans., Topeka—Kansas Hwy. Constr. Co., Great Bend, Kans., awarded contr. for constructing 27.5 mi. monolithic brick highway across Barton County, at $53,000 per mile—total of $1,457,000.

Ky., Paducah—Barrett Company, St. Louis, Mo., awarded contr. to pave West Broadway with tarvia.

Mich., Grand Rapids—Golden & Boter, Grand Rapids, awarded contract by Kent County Commrs., for bldg. 3¾ miles class B gravel road, 10 ft. wide, at $41,533.

Mich., Saginaw—F. Birchmeier, Chesaning, awarded contract for road construction by Saginaw County Rd. Commrs., at $23,-064.

Minn., Hibbing—Malmquist Bros., Woodhurst, Wis., awarded contr. for graveling Judicial and Ownes roads, town of Stuntz, at $2.65 per cu. yd.

Minn., St. James—J. McLaughlin & Sons, Care—Minnesota Pipe & Tile Co., Mankato, awarded contract by city for paving 20 blocks of streets in business sect. 44 ft. wide; residential sect. 36 & 40 ft. wide, at about $100,000.

Minn., Warren—American Drainage Co., Thief River Falls, Minn., awarded contract for 5 miles of road work at 18c per yard.

Mo., Kansas City—Michael Hess, Kansas City, awarded contract to grade sections of 58th and 57th streets at $2,590 and $1,487, respectively.

N. J., Bayonne—Culligan & Machansky, 473 Broadway, awarded contr. to improve Ave. C and 19th St., at $44,830.

N. M., Santa Fe—Dan LaRue, Palestine, Texas, award. contract for gravel surfacing road 21 miles in length from Tucumcari to Montova, Quay Co., at $102,000.

N. M., Tucumcari—D. LaRue, Palestine, Texas, awarr. contract for gravel surfacing 21 miles Tucumcari-Montova road, 16 ft. wide, at $102,341.

Ohio, Alliance—J. D. Faxon, awarded contract by Mahoning County Commrs. to build 3½ miles of concrete road in Goshen and Smith twps., to close gap in Youngstown-Sebring hwy., at $64,365.

Ohio, Canton—F. A. Downs, Construction Company, award. contr. for bldg. 265 ft. of Lincoln Hwy. in vicinity of Minerva, at $13,727.

Ohio, Cincinnati—Kirchner Constr. Co., awarded contract for improvement of Madison road—Erie Ave. to the Balt. & Ohio track, at $303,494.

Ohio, Cincinnati—Kirchner Constr. Co., awarded contr. for impvt. of Central avenue—4th to Liberty streets, at $118,327. Street will be paved with granite.

Okla., Idabel—S. B. McCartney, Valiant, awarded contr. to construct 28 miles of highway, at $200,000.

Ohio, So. Euclid—Following contracts awarded for furnishing material, grading, draining and constructing 6-ft. walk on Belvoir Blvd., Mayfield to Cedar Rd.; Carl Wilms, No. Miles, Solon, Ohio, gradings, at $12,194; Euclid Stone & Brick Co., Electric Bldg., Cleveland, walks, at $18,590; Curro Brothers, 12206 Mayfield Road, Cleveland, culverts, at $10,769.

Ohio—Youngstown—J. D. Paxon, awarded contr. to build 9½ miles concrete road in Goshen and Smith Twps., to close gap in Youngstown-Sebring hwy., at $64,365.

Okla., Chickasha—W. R. Palmer, Frederick, awarded contract by Grady Co., for bldg. 11 miles of road, at abt. $14,000.

Okla., Hominy—Jas. Stanton, Leavenworth, Kans., awarded contract for str. impvt., at $108,000.

Okla., Tulsa—Froebe-Gray Constr. Co., Muskogee, Okla., awarded contr. for constructing following roads: Sec. Y, State Road—6 mi. long; Sec. H., 6 mi.; Sec. K, 4 mi.; Sec. L., 3 mi.; N., 4 mi.; D., 7 mi. and A., 2 mi. at $68,683.

Ore., Portland—Following contracts let by State Hwy. Comm: A. D. Kern, grading

How is Your Concrete?

Does it Set Properly?

If not, don't put the blame on the cement—it has been tested at the mill and must come up to the required standard before being shipped to you.

What Grade of Sand are they Handing You?

Do you know before using it that it is *good* sand—sand that will insure satisfactory results when used with *good* cement?

The only way you can be sure is to test it with a

UNIVERSAL SAND TESTER With this simple device you can tell the grade of your sand—quickly and accurately—and keep a permanent record.

KOLESCH & COMPANY Sole Manufacturers

138 Fulton Street, NEW YORK CITY

Columbia river highway betw. Hood River and Mosier, at $242,641; E. T. Johnson, grading Columbia river hwy. betw. Arlington and Blalock, at $119,296; Blake & Compton, paving Pacific hwy. betw. Salem and Gervais, at $153,812; Oskar Huber, paving Pacific hwy. betw. Aurora and Gervais, at $230,547, 2 types asph.-conc. pavement bid on; one selected consists of 3½-in. base with 1½-in. top.

Ore., Portland—Warren Constr. Co., Journal Bldg., award. contr. by Comrs. Multnomah Co., for bldg. 4,000 ft. Canyon Road, Sec. A, asphaltic conc. on crushed rock base; Base Line Rd.,—63rd street to city boundary, asph. conc. on crushed rock base, at $11,920 and $25,643, respectively; United Construction Co., North West Bank Bldg., award. contr. for 2,500 ft. Canyon Rd., Sec. B., cement conc. paving on crushed rock foundation, etc., at $12,500.

Pa., New Castle—J. Clyde Gilfillan, Johnson Bldg., award. contract for grading Glenmore Blvd., betw. Highland Ave., and a point 150 ft. east of Delaware Ave., at $2,400.

Pa., Pittsburgh—Booth & Flinn, 1942 Forbes Street, awarded contract for grading, paving and curbing Guckert Way. T. Cronin, 17th and Murial Sts., also awarded part of this contract. Total cost abt. $186,300.

S. D., Deadwood—W. H. Butler, Lead, S. D., awarded contr. for 1.75 miles of road constr., at $13,410.

Texas, Dallas—Texas Bithulithic Co., awarded contract for resurfacing Grand Ave., Oakland to Meyers streets, at $6,750.

Tex., Dickens—J. T. Rose & Sons, McAdoo, awarded cntract by Dickens Co. Commrs., to construct 6½ miles of hwy. No. 18, at $33,000.

Texas, El Paso—El Paso County Commrs., awarded following contracts, totalling $97,100, for road construction: Noel Longuemare, at $6,500, 2 mi. gravel road; Dudley & Orr, $4,600, 1 mi. rock macad. rd. repair; Lee Moore Contracting Co., $26,000, 4½ mi. road repair (rock macad.); El Paso Bithulithic Co., $60,000; bithu. paving on Alamogordo Road. All of El Paso.

Texas Galveston—Suderman & Young, awarded contract for 10,000 yds. mudshell, at 55c per yard.

Texas, Lockhart — Mr. Montgomery awarded contract by Caldwell County to construct 4 miles graveled and sand-clay road bet. Luling and Harwood, State Hwy. No. 3, at $21,700.

Texas, New Braunfels—Haden & Austin, Houston, awarded contract for bitum., surfacing on crushed rock and gravel base on Austin-San Antonio Post Rd., at $52,959.

Texas, Palestine—D. LaRose, awarded contract by Anderson County Commrs. to construct Montalba Hwy., at $20,000; also Corsicana Hwy., at $40,000.

Texas, Roby—J. F. Horn, Sweetwater, award. contract for bldg. roads in District No. 3, about $60,000 available.

Tex., Waco—Texas Road Co., Dallas, awarded contract to resurface with bituminous materials all roads already surfaced, and 7 miles not heretofore surfaced, at $12,000.

Texas, Waco—Potts & Prentice, Waco, awarded contract for constructing gravel road, with conc. culverts and rock base, 1⅛ miles long, at $15,000.

Utah, Ogden—P. J. Moran, 152 W. 2nd Street, Salt Lake City, awarded contract for curbs, gutters and bithu. paving on concrete foundation on 3.5 miles of N. Washington Ave., at $154,051.

Utah, Salt Lake City—Geo. K. Elfrers, Arinosa, Utah, award. contract to widen 5½ miles of hwy. known as the Wendover cutoff, at cost of 10c a lin. ft.

Va., Ft. Myer—L. M. Johnson, Arlington, awarded contract by Constr. Div., War Dept., Washington, D. C., to surface Military Road. Fort Myer to Key Bridge, at $10,000.

Va., Newport News—Atlantic Bithulithic Co., Va. Railway & Power Bldg., Richmond, award. contract for paving to cost $100,000.

Va., Richmond—J. J. Pattershill, Virgilina, award. contr. by State Hwy. Dept., to bldg. 4.08 miles gravel road betw. Cabin Point and Burrowsville, Surry and Prince George Counties, at abt. $34,000.

Wash., Ritzville—T. Goodenough, Hatton, awarded contract by Commrs., Adams County, for grading, draining and surfacing 8½ miles Hwy. Impvt. 104, 28 ft. wide, crushed rock, at $54,997.

Wash., Seattle—F. N. Badolato, awarded contract for 1,000 cu. yds. of earth work, conc. curb and wood gutter, 1,220 lin. ft. conc. walks, 760 sq. yds., at $5,377.

Wash., Seattle—Stewart Constr. Co., American Bank Bldg., awarded contr. for improvement of 10th Ave., NE. by concrete retaining wall with approaches thereto and other work in connection with this project, at $59,882.

Wash., Spokane—H. C. Root, awarded contract by State Hwy. Comn., to surface 6 miles Central Washington hwy. betw. Etopia and Connell, with crushed gravel, at $21,850.

W. Va., Wheeling—C. B. Kimberley, 900 National Bank Bldg., awarded contr., for 374 sq. yds. paving on Lalawells Run; also conc. wall, at about $10,000.

W. Va., Williamson—Vaughn Construction Co., Shawsville, Va., award. contr. for bldg. 8 miles earth road betw. Naugatuck Twp. and Wayne County line, at $70,000.

SEWERAGE AND SEWAGE TREATMENT

Ark., Morrillton—S. R. Morgan & Co., Little Rock, awarded contr. by Comrs. Sewer Distr. No. 2, for bldg. sewer involving 15,900 lin. ft. vitr. pipe, 51 manholes, reinf. conc. septic tank, etc., at abt $16,000.

Ariz., Globe—Clarke-Henry Constr. Co., 38 So. Sutter St., Stockton, Cal. awarded contr. to build sanitary sewers and sewage disposal plant, cement pipe, at abt. $226,400. Project consists of 2 Imhoff tanks, 2 sludge beds, 1 chlorinator house, involving 15,000 cu. yds. earth excav., 1,000 cu. yds. rock excav., 500 ft. high fence, 93,887 ft. 6-18 in. pipe, 92,224 ft. trenching and back-filling, 4-12 ft. cuts, 60 ft. 18-in. and 120 ft. 8-in. pipe, 120 cu. yds. conc. work, etc., etc.

Can., Walkerville, Ont—Pettypiece, Ltd., Amherstburg, awarded contract to construct 700-ft. sewer in Kildare road, Walkerville, at $2.35 a ft.

Ill., Warsaw—J. J. Jobst, 1098 Jefferson Street, Peoria, awarded contr. for bldg. sewer, at about $30,000.

Ia., Waterloo—Blackhawk Constr. Co., City, awarded contr. for constructing storm sewers, at $8,000.

Md., St. Helena—Fisher & Carozza, 803-7 Calvert Bldg., Baltimore, award. contract for bldg sewage pumping station, at abt. $50,000.

Mass., Boston—Frank Drinkwater awarded contract by Commr. Public Wks., for bldg. sewerage works in Archdale road and South street, betw. Washington and Lesher streets, West Roxbury, at $5,404.

Mass., Bridgewater—W. H. Connor, 3 Main Street, Middleboro, Mass., award. contract for sewer extension on Ball Ave., at $3,000.

Minn., St. Paul—O'Niel & Preston, St. Paul, awarded contract for furnishing material and constructing sewer on Lafons street, Lexington avenue to Griggs street, at $3,485; E. T. Webster, St. Paul, awarded contract for furnishing material and constructing sewers on Page street, 75 ft. east of Humboldt avenue to State street; on So. Robert street, Morton street to southerly intersection with Page street; on Gorman avenue, 75 ft. no. of Morton street to Page street, at $6,255.

N. Y., Albany—Smith Soper, Seneca Falls, N. Y., awarded contr. for improving Cayuga and Seneca Canal, Sec. No 1, repairing manholes of sewer in Benton Creek, Seneca Falls, at $7,382.

N. Y., Corona—A. M. Hazell, 26 Cortlandt St., New York City, awarded contr. for bldg. sewer in 43rd street from Flushing Bay line, at abt. $19,000.

N. Y., Long Island City—Carmine Contracting Co., 840 Kent Ave., Brooklyn, awarded contract for bldg. sewer in Wool street, Grand to Weimer streets; Koerner street, Weimer to point east of Wool street and others, at $14,019.

N. Y., Plainview, L. I—Barnet Constr. Co., 150 Nassau St., New York City, awarded contract for drainage basins and drains, etc., at $1,293.

N. Y., Syracuse—Chas. Boon, 207 Delphi Street, awarded contr. for sewer in Court street, 7th North St., to Hood Ave., at $3,446.

N. Y., Syracuse—John Young, City, awarded contr. for furnishing material and constructing section "A" of west branch of the 17th ward sewer, Lombard street, from Maple street to point approx. 1580 ft. easterly, to $39,085.

N. Y., Yonkers—Jas. J. Corbalis, awarded contract for constr. of an outlet to the Herriot street sewer, at $3,749. Construction will be of cast iron pipe instead of the wooden flume as originally planned.

Ohio, Cleveland—Zegiob & Joseph, 1200

The Ideal and Perfect Purifier of Water

Ozone is the most powerful germicide and oxidizing agent known to science. It is direct acting and goes right to the point at once.

Ozone purifies water by removing Bacteria, Tastes and Odors. It has been used long and successfully in France and other European countries. It is equally well suited for municipal or institutional, large or small plants.

You will have sterile water; 100% protection against epidemics resulting from water-borne diseases by installing an

Electric Ozone Sterilizer System

It destroys and consumes—literally removes from the water ALL harmful germs and organic impurities—positively—unfailingly—regardless of how much the raw water may be contaminated.

No chemical is used. No residue left in water. Operation simple. Adjustable to varying demands. Adaptable to the largest or smallest project, private or public—anywhere—any water source. Can be connected to plants now installed. No objectionable features. Results certain. Approved by the World's Greatest Water Works Engineers.

ELECTRIC OZONE STERILIZER CO. of America

726 Monadnock Block
CHICAGO, ILL.

Bolivar Road, Cleveland, Ohio, awarded contr. for constructing sewer in Carnegie avenue, S. E. from 87th St. to E. 100th St., at $6,289.

Ore., Portland—Plans being prepared for constr. of Peninsula District Sewerage System during 1919. First unit will cost approx. $750,000 and embraces Portsmouth, Piedmont, Kenton and Alberta districts. Ultimate cost will be $3,000,000. Sewers will also be laid in Giesan street, 10th to Willamette River; also in Quimby street.

Okla., Tulsa—Comstock & Hansen, awarded contract for construction of sewer extension in District No 147.

Pa., Bethlehem—Frank Glassmire, 601 Prospect Ave., awarded contr. for sewers along Lehigh River, at $7,500.

Pa., No. Braddock—Thos. George, awarded contr. for sewers in Grant and Dunba Aves., at $5,066.

Wis., Sheboygan—E. Oldag, Jr., Co. Sheboygan, awarded contract by City for bldg. sewers in So. 14th, 15th, 16th, 17th and Henry Sts., and Oakland and Ashland Aves., at $24,987.

Wis., Sheboygan—Peter Frandsen, award. contract for sewer constr., by Bd. of Public Works.

Wis., Elkhorn—Wisconsin Drainage Co., awarded contract for storm sewer, West Side, at $4,775.

WATER SUPPLY AND PURIFICATION

Cal., Martinez—M. P. Holmes, Martinez awarded contr. for constructing conc. reservoir, pump house and stand pipe for municipal water system, at $31,180.

Cal., San Francisco—Schultz Constr. Co., 46 Kearney St., San Francisco, awarded contr. for bldg. reservoir for U. S. Govt., at $4,844.

Ind., Hartford City—Chas. Krauss & Sons, Indianapolis, Ind. awarded contract for drilling two 10-in. water wells for Fort Wayne Corrugated Paper Co.

Ia., Mona—Blackhawk Constr. Co., Waterloo, awarded contract by Ill. Cent. R. R. Co., Chicago, for constr. of water works plant, at $3,000.

Ia., Charles City—Blackhawk Constr. Co., Waterloo, awarded contract for water works plant; 65 ft. high, frm. constr. at $3,000, Owner Ill Cent. R. R., Chicago, Ill.

Md., Baltimore—Price Construction Co., Maryland Trust Bldg., City, award. contract to remodel interior of boiler-house, at cost of $4,000.

Md., Dickeyville—Price Constr. Co., Maryland Bldg., Baltimore, awarded contr. for constructing one story pump station for Baltimore Co., Water & Electric Co., at $15,000.

Md., Indian Head— Scott Bros., 120 N. Washington St., Rome, N. Y., award. contract by Navy Dept., for constr. of water system, at $45,955.

Mich., Grand Rapids—Vander Weele Bros., awarded contr. for installing water main in Fox street from Buchanan avenue to 275 ft. west., at $13,075.

Mich., Wyandotte—Pitt Constr. Co., Fulton Bldg., Pittsburgh, Pa., award. contr. for bldg. filter plant, 6,000,000-gal. capy., composed of 6 filter units, brk. & steel filter & head houses, 2 coagulation basins, filtered water reservoir having capy. 850,000 gals., usual equipt. hydraulic valves and controllers, & 32-50 ft. brk. addn. to pumping sta., using wood piles with altern. on reservoir, at $195,485.

Minn., Washington—W. Danforth, Germania Life Bldg., St. Paul, award. contract for bldg. filter plant for So. Western Minn. Sanitarium, at $13,660.

N. D., Elgin—J. Kennedy, Fargo, awarded contr. for pumping machinery and wells, and bldg. 50,000 gal. steel tank on 100-ft. steel tower, at abt. $30,000.

Ohio, Hamilton—A. J. Yawger, Indianapolis, Ind., award. contract for water works improvements, at $50,000. F. E. Weaver, City Engr.

Ohio, Toledo—Spear, Moylan & Lasley, City, award. contr. for removing temporary balcony, brick pump pit walls, etc., and constructing conc. steel balcony supports, railings, stairs ando ther impvts. in Water Works Pumping Station at Broadway and Hawley streets, at $24,600.

Ohio, Toledo—L. Skelton & Co., Nicholas Bldg., awarded contract for remodeling water works at Brookmorep umping station, at $25,000.

Va., Quantico—Donnell Zane Co., 309 Broadway, New York, awarded contract by Navy Dept., Washington, D. C., to construct 2 rein. conc. tanks, at $4,800.

Va., Yorktown—Boyles-Robertson Constr. Co., Evans Bldg., Washington, D. C., awarded contr. for constructing water storage plant, at $280,568.

Wis., Milwaukee—Herman Hohensee, 965 27th St., City, awarded contract for furnishing materials and constructing water pipe tunnel under Menomonee River, West Alter Street to Reed Street and two shafts, and for laying a connecting water pipe line at location. Work embraces constr. of 2 steel-lined conc. shafts, a reinf. conc. lined tunnel, placing in position in shafts and tunnel of a c.i. water pipe line and laying of extensions to connect with existing water pipe lines, both north and south of proposed water pipe tunnel, at $90,427.

BRIDGES AND BUILDINGS

Cal., Madera—Bids rejected for constr. of bridge in 5th Supervisorial District over Cottonwood Creek. Supervisor Ellis will construct bridge, at cost of $1,700.

Fla., Marianna—Converse & Co., awarded contr. for constr. of bridge to span Apalachicla river at Chattahoochee, at abt. $180,000. Bridge will connect East and West Florida.

Fla., Tampa—Tampa Steam Ways Co., City, awarded contract for constructing 24 pontoons for corps of engineers U. S. Army, at $480.

Ia., Des Moines—Plans for conc. bridge across Close's creek at Forest Ave., practicallyc ompleted by city engineer's department. Specifs. call for 30-ft. rdway and two 6-ft. walks; also 36-ft, foot arch which will span proposed blvd. to northwest section of city. Structure will be 136 ft. long and will be faced with Bedford stone.

Ind., Fort Wayne—Contracts for bridges awarded by Co. Commrs., Allen Co. as follows: Geo. Jaap, Rochester Bridge Co., Chas. Eleing, Stone & Smith, Elkhart Bridge Co., Chas Smith and Julian Sweet, at $17,645; $10,445; $8,607; $6,456; $5,895; $1,880, and $1,130, respectively.

Kans., Hiawatha—Brown County will construct 22 bridges and culverts by day labor.

La., New Iberia—A. Bond, Austin, Texas, awarded contr. for constr. of bridges, roads, etc., at $70,000.

Minn., Warren—P. H. Grammer, Crookston, Minn., awarded contr. for the installation of culverts in ditches Nos. 31 and 31,

Stimulate Necessary Public Works of All Kinds during the period of Demobilization

The President of the United States and the Department of Labor urge the undertaking of public works programs to provide useful and profitable employment for labor at this time.

The Secretary of the Department of Labor recently sent the following letter to the chief officials of the 4,000 counties of the United States:

Are you planning any public works in 1919?

Now is the time to catch up on road repairs and new roads postponed on account of war conditions.

The National Association of State Highway Officials is agreed upon the desirability of a large program of road construction in 1919.

About forty millions of Federal appropriations are available in aid of state and county roads.

If our country had been invaded we should have had to strain our resources by borrowing vast sums to restore the ravages of war. Let us in thanksgiving for our security expend a small fraction of that vast sum now in improving American roads and in developing public works which minister to the needs and comfort of our people.

If your county will prepare to do necessary public works in 1919, it will help to diminish any unemployment that may temporarily result from demobilization and the shifting of war workers.

Not only will your necessary public works employ workers in your locality, but they will help to steady the employment of workers now engaged in producing the materials required, and they will also enable the industries producing such materials to employ additional workers from among returning soldiers and munition workers. Consequently the benefits of any necessary public works done by your county during a period of unemployment will extend to the whole nation.

What will you do?

The Michigan Jr. Gravel Screener and Unloader

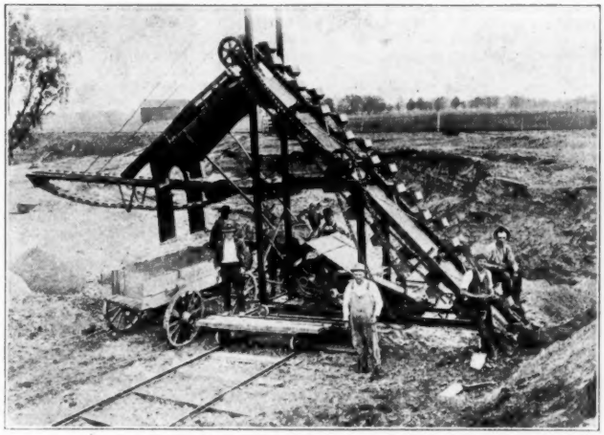
A Machine that will take the Gravel out of the Pit or Pile, Screen out the Sand and Stones and Load the Gravel into Wagons or Trucks.

The machine runs up and down the side of the pit or pile on a track and takes off a slice of about four feet at each time over the track. After going along the track once, the track is moved over and the loader returned along the side of the pit or pile.

The Screener and Loader is self-contained, furnishing its own power, and has an attachment on the screen that prevents it from clogging up with clay, clods, etc. The machine runs up and down the track, also out and into the gravel bank by the power of the engine.

The loader delivers the screened gravel next to the machine, and the sand and stones separately twenty feet away where they will not have to be moved.

The Screener and Loader is just what County Road Commissions, Township Boards and Road Building Contractors have been looking for to take sand out of the handy gravel pits so the gravel will pass state inspection and make a good road.



Calhoun County (Michigan) owns and operates four of these machines, and contractors own three others, making seven in the County.

For further particulars write to

THE JORDAN & STEELE MFG. CO., Inc.

CHARLOTTE, MICH.

KAHN ARMOR PLATE

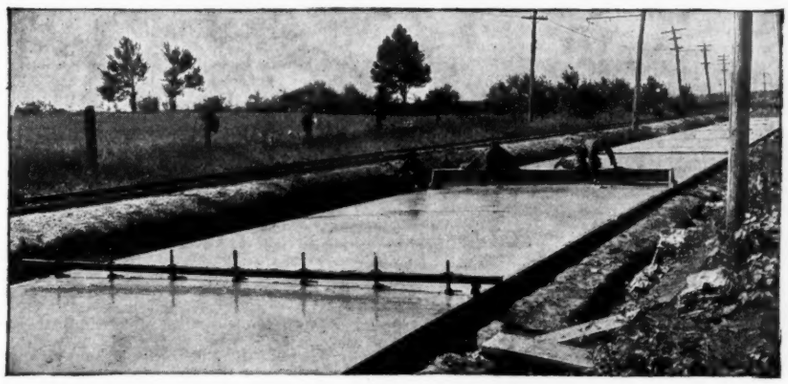
Perfectly protect expansion joints. The split end prongs assure positive anchorage in the concrete, and plates are correctly placed by our improved Installing Device.

KAHN ROAD MESH

Large flat sheets easily handled—no unrolling of coils nor cutting to length. The most efficient reinforcement for concrete roads and pavements.

KAHN CURB BARS

Protects and reinforces concrete curbs. Strong, rigid, convenient, easy to in stall. Furnished straight or curved.



Allentown-Eaton Road, Pennsylvania. Mr. Eubler, Engineer.

THE ROAD THAT WITHSTANDS HEAVY TRUCK TRAFFIC

Concrete roads meet present day requirements of a road to stand up under heavy motor traffic; economical to build; materials obtained locally; practically no labor expense for maintenance.

Perfect concrete roads are obtained by the use of Kahn Highway Products for reinforcing the concrete and protection of the joints; also reinforcing the concrete curbs.

Write for free Highway Catalog and estimates

TRUSCON STEEL COMPANY

(FORMERLY TRUSSED CONCRETE STEEL CO.)

YOUNGSTOWN, OHIO.

WAREHOUSES AND REPRESENTATIVES IN PRINCIPAL CITIES

TRUSCON STEEL CO. TRUSCON BUILDING PRODUCTS

Marshall County. $8,000 worth of culverts will be placed.

Minn., Warren—Minneapolis Bridge Co., 1035 Metropolitan Life Bldg., award. contr. for 1 reinf. conc. culverts, 5 steel bridges and 15 wooden.

Miss., Hattiesburg—Munson & Welborn, City, awarded constr. for bldg bridge 3 miles from Brooklyn, at $3,000.

Miss., Vicksburg—Vicksburg Boiler & Iron Works, City, awarded contr. for repairing Baldwin Ferry Bridge, at $5,949.

N. J., Jersey City—Vassilarios Cox, Nassau Street, New York City, award. contr. by Penn. R. R., Broad St., Philadelphia, for painting, scraping and repairing following 7-track bridges on Erie, Coles, Monmouth and Brunswick streets and Jersey Avenue, at abt. $15,850.

N. J., New Brunswick—Linde & Griffith Co., Newark, N. J., awarded contr. for constructing Strauss trunion bascule draw span and conc. encased girder approach spans over Delaware and Raritan Canal on Albany Street, at $128,575.

N. Y., Geneva—Mohawk Dock & Dodge Co., Herkimer, awarded contract by State Hwy. Dept., for constr. of new truss bridge over Cayuga and Seneca Canal at Lake Street, Geneva.

Ohio, Marion—L. B. Brady, local, awarded contr. for constr. of the substruct. for bridge across Tymochee creek near home of B. E. Smith, Grand Twp., at $4,119.

Okla., El Reno—G. M. Stone, awarded contr. by Canadian Co., for bldg. 7 bridges, at abt. $12,580.

Okla., Mangum—W. B. Henry, City, awarded contr. for bldg brdg., culvert and earthwork, embraced in State Sid Projects Nos. 2, 3, 5, and 7, excavating and fill, at 24c per cu. yard.

Okla., Tulsa—Roach & McNulty, City, awarded contr. for constructing culverts, at $8,828.

Ore., Grangeville—Bridge across South Fork of Clearwater river at Golden will be built in near future. Work will be done by A. S. Johnson, of Golden and will be financed by county miners of the Ten Mile sect., and stock men. Est. cost of brdg. $1 500.

S. D., Deadwood—Hanson Bros., Deadwood, S. D., awarded contr. for retaining walls, culverts and similar concrete work for year 1919.

Tex., Dallas—W. H. Cramer, Dallas, awarded contract to construct conc. bridge across Mill Creek at College Street and Gaston Avenue, at $3,879.

Wash., Yakima—C. G. Huber, Seattle, awarded contr. by Yakima Co., for constr. of 5 bridges in Naches valley, at $23,344.

Wis., Sheboygan—Worden-Allen Co., 208 S. La Salle Street, Chicago and also of Wausau, Wis., awarded contract for constr. of steel bridge over Sheboygan River, at $67,000.

Wis., Sheboygan—Wausau Iron Works awarded contract for constr. of bridge over Sheboygan river at Fourteenth street, at $62,700. Bridges will be built of steel with conc. piers and abutments; entire length 223 ft., and will be constructed with slight incline to meet surface of street at each side of river.

DRAINAGE AND IRRIGATION

Ark., Arkadelphia—H. J. Sternberg, St. Louis, Mo., awarded contract by Ross Draing. Dist. Clark Co., to construct drainage sys., to reclaim Terre Noir Crk. bottom lands; 170,000,000 cu. yds. excav., drain 23,800 acres. Will issue $200,000 bonds. Willis E. Ayers, Engr., Randolph Bldg., Memphis, Tenn.

Cal., Blythe—Palo Verde Mutual Water Co., awarded contr. by Palo Verde Joint Levee Distr., for rock revetment along river for 7,000 yds., at $2.00 & $2.50 per cu. yd.; O. H. Ellis Contracting Co., Blythe, Contr. for 40,000 yds. of work, at 49¾c; barge and pile drive contracts awarded to Geo. Kirby, Blythe.

Cal., El Centro—Leroy Little, Calexico, awarded contr. to finish and extend Saiz levee for Imperial Irrig. Dist. Approx. quantity of earth work, 320,000 cu. yds. His bid, 39c cu. yd.

Cal., El Centro—L. Little, Calexico, award. contr. for levee work on Imperial Irrig. Distr., on Carillo cut, Mexico, at $46,673.

Fla., Bradentown—Foster & Long, City, awarded contr. for constructing public drain in Manatee Co., known as Oneco Drain and Laterals, at $24,732, also contract for constructing public drain, Manatee Co., known as Pierce Saw Grass Draing. Dist., at $32,207.

Ind., Greenfield—Wm. L. Dillon, Detroit, Mich., awarded contr. for furnishing material and constructing Wm. L. Cook et al Drain, Brown Twp., Hancock County, at $9,100.

La., Lake Charles—Lake Arthur Dredg. Co., award. contr. by Sulphur Draing. Dist., No. 3, for draing. wk. on Sec. 1, at 19½c; sec. 2, at 16c & sec. 3, at 19¼c; 18½ mi. feeder canals, 12½ mi. laterals & 6 mi. main outfall canal, etc.

Mich., Adrian—C. B. Miller, Britton, Mich., awarded contract for constr. of the Coates Drain, at $5,750.

Minn., Glenwood—Cole & Quigley, Morriss, Minn., award. contr. for County Ditch No. 7 and branches, at $5,968.

Minn., Olivia—Clyde A. Walb, La Grange, Ind., award. contract for Judicial Ditch No. 16, at $119,465.

Minn., Olivia—Olson & Johnson, Minneapolis, awarded contr. for Judicial Ditch No. 21, at $17,404.

Minn., Willmar—Olson & Johnson, Minneapolis, awarded contract by Kandiyohi County, for constr. of Ditch No. 21, at $17,404.

Mont., Forsyth—Chas. Ball, awarded contr. for wing dams and dykes, at $95,000.

Tenn., Brownsville—Following contracts awarded by Kinney & Willis, attys.: N. C. McGimica & Co., Memphis, enn., for constr. Poplar Crk. canal, involving 145,670 cu. yds. excav., at 12c per cu. yd.; F. M. Horton, 140 S. Dearborn street, Chicago, Ill., for Big Muddy Crk. Canal, involving 279,760 cu. yds. excav., at 12.4c per cu. yd., and Indiana Dredging Co., Royal Center, Ind., for Kail Crk. Canal, involving 119,790 cu. yds. excav., at 14¼c per cu. yard.

Tex., Austin—W. E. Dozier, City, awarded contr. for constructing conc. drainage structures, at $30,000.

PROSPECTIVE WORK

ROADS AND STREETS

Ariz Bisbee—$1,000,000 will be expended by Cochise County for road construction in 1919.

Ark., Coy—Preliminary plans completed by State Hwy. Dept. for constr. of bitum. line, at est. cost of $169,183.

Ark., Pine Bluff—Jefferson County Road Impvt. Dist. No. 22 will construct road 18 miles long, Sherrill to Pine Bluff, Altheimer and Little Rock. J. F. Quattlebaum, Commr.

Cal., Fairfield—$1,696,200 will be required to construct modern system of highways for Solano County. Proposed hwy. system will include constr. of 102 miles of permanent roads; the most important ones to be conc. and the laterals of bituminous or oil macadam. E. J. Wulff, Govt. Engr.

Cal., Fresno—Bd. Supvrs., Fresno County, plans to issue $5,000,000 bonds to build highways. C. Jorgensen, Chrmn. of Board.

Cal., Sacramento—$1,042,788 submitted by T. A. Bedford, Division Engr., State Hwy. Comn., as cost of proposed state hwy. lateral through north for Feather River, as follows: Excavation, $750,033; corrugated pipe, $47,656; concrete & masonry, $114,750; steel $16,221 cement, $16,530; engineering, 10 per cent, $94,799. This also includes constr. of small concrete culverts and bridges up to 20-ft. span.

Cal., San Bernardino—Surveys now being made by State Hwy. Comn. for paving Cajon Pass, Summit to Victorville. County will pave road from Victorville to Barstow under an agreement with the state.

Cal., San Diego—Chamber of Com. has requested Council to pave 11 miles of road from La Jolla to Indio and Winder streets, to complete San Diego-Los Angeles Hwy.

Cal., Santa Ana—County Supvrs. contemplate paving 3.65 miles of Santa Ana canyon road; also road from El Molena to county park.

Cal., Santa Barbara—City Engineer has received Council's orders to proceed with the preparations for plans for proposed improvement of East blvd. Street project will cost $100,000; bulkhead, $200,000.

Cal., Santa Barbara—Legislature will be asked to provide $5,000,000 for constr. of an all-coast hwy, from Santa Barbara to San Diego, now that there is a prospect of opening road through Malibu ranch to Ventura county line.

Can., Windsor, Ont—Resolution passed by Essex County Council favoring proposed Dominion Hwy., Windsor to Montreal. Road may run through county via Blenheim and St. Thomas to London.

Colo., Denver—1919 budget just completed shows $1,043,185.45 will be expended on hwy. construction. The construction of head centers along main traveled north and south hwy., in the hope of later joining tre towns with unbroken stretches of concrete includes the following: continuation of hard-surfaced pavement on the Brighton rd., for 2 mi. in Adams County; one mile so. out of Greeley in Weld Co.; one-half mile east out of Boulder and one-half mile so. out of Longmont, Boulder Co.; one-half mile so. out of Sterling, Logan Co.; one-half mile out of Ft. Morgan, Morgan Co.; 1½ mi. north of Colo. Springs; 2 miles east out of Pueblo; ½ mile east out of Rocky Ford and many others.

Colo., Denver—Construction work on Fall River road next year will include 9 miles on top of the divide, for which $60,000 was appropriated recently.

Fla., Tampa—Construction work on a number of roads will begin at once. $875,000 bonds for the work have been sold.

Fla., Tampa—Moore Haven Road District will expend about $90,000 for roads in district.

Ga., Atlanta—City contemplates street impvts.; H. L. Collier, charge of construction, has submitted report for 1919 recommending paving of 28 principal streets. Est. cost $1,208,148.

Ga., Atlanta—Judge J. E. Patterson, Chm. Georgia State Hwy. Com., has issued statement advocating state bond issue of $40,000,000 for purpose of bldg. system of hwys.

Ga., Macon—Bibb County Commrs. contemplate bond issue in sum of $1,200,000 for improvement of roads, bldg., schools and courthouse.

Ga., Savannah—Chatham County Commrs. have ordered election to vote on one million dollar bonds for purpose of paving Ogeechee, Louisville and Augusta roads with permanent material.

Ill., Pecatonica—Winnebago County plans to issue $1,500,00 bonds for completing this year the hard roads that would be included in the sixty million dollar bond issue; the money to be returned to the county when distribution of the sixty million dollars takes place.

Ill., Rockford—City considering paving Montague street—Main street to city limits—with concrete. Est. cost, $43,250.

Illinois—Commrs. Macoupin County (Carlinville) having plans prepared for bldg. Springfield-St. Louis Rd., 16-18 ft. wide, brk. or conc. Abt. $160,000. H. E. Bilger, Springfield, Rd. Eng.; Commrs. Madison County (Edwardsville) having plans prepared for bldg. 9-10 mi. Alton-St. Louis Rd., 18 ft. wide, brick. Abt. $277,000. W. E. Holden, Co. Supt. Hwys.; Commrs. Kane County (Geneva) will ask bids in Spring for bldg. Lincoln Hwy. west of Elburn, 16 ft. wide, brick or conc. Abt. $93,100 available. M. J. Tarble, Co. Supt. Hwys.

Ill., Springfield—City plans to repave 66 blocks of city streets in business district with wood blks., and numerous residence streets with brick.

Ind., Decatur—43 petitions for macad. roads in 10 of the 12 twps., have been filed with Commrs. of Adams County.

Iowa, Atlantic—Cass County Commrs. planning to construct White Poli Rd. Est. cost $44,000. Fed and State Govt. will appropriate funds; Davenport—List of streets to be either paved or repaved prepared by Bd. Pub. Wks. If plans are adopted 12 miles of streets will be improved; Sioux City—Paving of Wall street viaduct will be one of the first impvts. to be undertaken by city.

Iowa, Denison—Highway may be built through western Iowa and Nebraska, starting at Denison, through Onama, Norfolk, Burwell, Bartlett, Decatur, Bancroft, Elgin, Taylor, Sargent, Anselmo, Tryon, Arthur and Broadwater, Neb., with branches at Merna, Alliance and other towns.

Kans., Dodge City—Plans being prepared for paving with brick the Santa Fe trail—Dodge City to Gray county line.

Kans., Junction City—Plans being prepared for constructing 7½ mi. of conc. road 18 ft. wide in Geary County. Total est. cost $152,702. B. Boyl, County Engr.

Kans., Wichita—Sedgwick County having plans prepared for bldg. Central Ave. Rd. Abt. $250,000; County also considering constr. of 13 miles on Meridian Road, 20

DU PONT AMERICAN INDUSTRIES

Better Highways

The time is near at hand when contractors are going to have plenty of labor offered them. But contracts? The tendency is to wait for normal conditions, say those having work to offer. It will probably be some months before it is determined what normal wages of labor and normal prices of building materials are to be.

But there is one class of work in which the contractor is vitally interested that is not going to wait for anything. It is Road Building. There is a tremendous movement developing in the United States toward better roads, and it is realized that now is the time to get them.

Everybody interested in good roads—and that surely includes all readers of this paper—should get back of the idea and push! Keep the interest alive; do all you can to intensify it; talk good roads to local editors, bankers, business men, farmers, truck owners, autoists, etc.; and bring pressure to bear on those having the power to make appropriations, to authorize and approve bond issues, etc. In short, crystallize the road building interest; get the work actually under way.

Road building will provide work for returning soldiers and discharged munition workers; take contractors out of the "nothing doing" class and make them the busiest of the busy; give road supervisors something to think about besides making excuses for bad highways; make the quarries and stone crushers prosperous; boom sales of road machinery, cement, asphalt, tar, etc.; enable the farmer to get more closely in touch with town and city markets, sell more cheaply and deliver produce more regularly; decrease transportation costs, relieve delays and increase the pleasure of automobiling.

Write for our Road Construction and Maintenance Booklet No. 76. It's free. It contains a lot of modern information about road building, road machinery, economical use of explosives, etc.

E. I. du Pont de Nemours & Co.
Wilmington, Delaware

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PERFORMANCE
IS WHAT COUNTS

WHEN A
LITTLEFORD
PORTABLE
Tar and Asphalt Heater
Is on the job Performance is Assured

Street and road contractors everywhere tell of the service rendered by their **Littleford Equipment.**

It is worth big money to you to have a heater built with a big "safety margin," the extra strength which forestalls those money-losing delays on the job.

The **Littleford Tar and Asphalt Heaters** are built to stand severe service. They not only give *good* service but *long* service.

Sizes from 50 to 900 gallons.

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LITTLEFORD BROS.
460 E. Pearl St. CINCINNATI, OHIO.

ft. wide, brick. Abt. $460,325. M. Roseberry, Co. Engr.

Ky., Louisville—City will reconstruct sections of Market, Jefferson, Liberty, Walnut, Breckenridge, Portland, Bank and other streets—probably with concrete. David R. Lyman, City Engr.

La., Baton Rouge—East Baton Rouge Parish will soon vote on proposition to construct 345 miles of roads throughout parish. W. E. Atkinson, Eng., is preparing plans providing for 71 miles of conc., and 274 miles of gravel highways. Est. cost, $2,500,000.

La., Franklinton—Washington Parish will construct roads; $500,000 bonds voted for this purpose. Chas. M. Kerr, Ch. Engr., State Hwy. Comn., New Orleans, has begun preliminary survey. State and Fed. aid has been applied for.

La., New Orleans—Govt. aid in sum of $270,000 obtained for constr. of several important hwys. in state. Expendt. of the district, parish, state and government will exceed $5,000,000. Work planned during year include completion of links in roads betw. New Orleans and Lake Charles and New Orleans and Shreveport. Duncan Buie, head of State Hwy. Dept.

La., New Orleans—City contemplates expendt. of $1,500,000 for constr. of street paving in 1919; abt. two-thirds of this construction work had been postponed on acct. of the war.

Maine, Augusta—State Hwy. Comn., Augusta, contemplates expendt. of $2,669,000 to build state and state-aid highways and bridges; also $700,000 for maint. of other righways. P. D. Sargent, Chf. Engr.

Md., Baltimore—City will have $26,000,000 available for expendit. during 1919 by various municipal departments; of this $23,822,098 is provided for in new appropriations and $1,750,000 remaining unexpended during present year. Expenditures will include: $356,620 for impvts. of streets in Old Annex; $250,000 for opening new streets; $40,000 for extension of Gwynns Falls Pkway; $520,000 for paving, repaving and resurfacing and improving roads and streets; $20,000 for purchase of municipal plant for repairs to smooth streets, etc., etc.

Md., Westminster—Carroll County Commrs. will construct New Windsor Road, at cost betw. $40,000 and $50,000; also Littlestown Road; state aid; est. cost $300,000.

Mich., Battle Creek—Calhoun County will construct following: Duck Lake Rd., Marengo twp., 5 mi. Est. cost, $20,000; Burlington & Tekonsha Rd., 2½ miles, est. $12,000; Partello Rd., Lee Twp., 3½ mi., $16,225; Homer and Groverville Rd., Homer Twp., 2 mi., $8,000; Clarendon Center Rd., Clarendon Twp., 2¼ mi., $11,225; Ellis Corners Rd., Fredonia Twp., 4 mi., $20,000; Burlington & Cresco Rd., Newton Twp., 3 mi., $12,000; Pierce Rd., Emmett & Marshall Twps., 1mile, $5,000; Gorsline Rd., Pennfield Twp., 3¼ mi., $16,000; St. Mary's Lake Rd., Pennfield & Bedford Twps., 2.6 mi., $13,000. To cover cost of this work Bd. of Supvrs. has authorized sale of $145,000 of recent $800,000 bond issue recently voted.

Mich., Benton Harbor—$65,000 avilable for bldg. 5 additional miles of the Watervliet road through to Coloma.

Mich., Jackson—Petition presented to Bd. of Supvrs. to bond county in sum of $1,400,000 for constr. of gravel and paved roads; the bond issue to be submitted to citizens at April election.

Mich., Lansing—Senator Wm. C. Connelly, Spring Lake, will present proposal to Senate to expend $50,000,000 for good roads in state; election to be called in April to vote on bonds in this sum.

Mich., Saginaw—If present plans are carried out construction work will start in early Spring on road from Detroit to Saginaw to Midland and thence west to Ludington.

Minn., Anoka—Anoka county commission has appropriated $240,000 to build 12.7 miles hard-surfaced road. From Minneapolis city limits to Anoka city limits will be graveled; Anoka city limits west to Sherburne county line, 6.7 miles, will be hard surface paved road. Work will start early in Spring.

Minn., Hastings—Dakota County will start work early in Spring on 5 mi., of hard surface road to connect with city limits of St. Paul. R. W. Downs, aud.

Minn., So. St. Paul—City will pave Concord avenue—South Park to St. Paul city limits—in Spring. Est. cost, $200,000. J. R. Stevenson, City Clk.

Minn., Tracy—City will ask bids in March for paving 25 blocks in bus. section, 44 ft. wide; residential sect. 36 ft. wide, concrete. About $75,000. J. W. Shaffer, New York Life Bldg., Minneapolis, Engr.

Miss., Cleveland—Bolivar County, Boyle Rd. Dist. will issue $50,000 bonds for road construction; Shaw Road Distr., Bolivar County will issue $75,000 bonds for rd. constr. P. B. Woollard, Clk. Bd. of Supvrs.

Miss., Jackson—State Hwy. Commission will construct highways under supervision of Xavier A. Kramer, State Hwy. Engr., Magnolia, Miss. $3,000,000 now available; $1,000,000 additional may soon become available.

Mo., St. Louis—List of municipal impvts., prepared by Harland Bartholomew, Engr., of City Plan Commission, are as follows: River de Peres channel, sewer, industrial railroad and drive, $11,375,000; sewer constr., costing $5,205,000; city's share of grade crossing elimination, $3,192,000; parks and playgrounds, $2,100,000; municipal docks, $750,000; garbage reduction plant, $550,000; street department work, $450,000; municipal auditorium and convention hall, $2,660,000, etc., etc.

Mont., Missoula—If plans of Mineral County and forestry service are carried out, the "Camel's Hump" on main hwy. betw. St. Regis and Henderson—one of the most dangerous grades in the state, will be eliminated. Est. cost of work, $100,000. It will be necessary to build 10 miles of road to eliminate this dangerous stretch.

N. H., Concord—State Hwy. Comn. has asked legislature for appropriation for road work, which together with Fed. aid and increase in motor vehicle fees will amt. to $1,500,000. Abt. $900,000 will be expended for constr. and $600,000 for maint. F. E. Everett, Comr.

N. H., Franklin—Ashphalt boulevard may be built betw. Franklin and ilton. State Hwy. Dept. has estimated that an 18-ft. rdway of this type betw. the two places named will cost abt. $45,000. It is expected $15,000 can be obtained from govt. fund for rd. bldg., while state and town of Tilton and city of Franklin will make up balance.

N. J., Trenton—State will constitute 50 miles of paving during 1919. Total cost of work, $1,980,851.

N. M., Tucumcari—Plans for promotion of hwy., extending from Kansas City, Mo., to El Paso, Texas, running parallel with Rock Island R. R., have been made. Road will be known as Funston-Fort Bliss Military Hwy.

N. Y., Bath—Steuben County Bd. of Supvrs., has authorized improvement of following pieecs of highway in several towns of county; work to be done at expense of county at $2,500 per mile; Wheeler-West-Creek, 1 mi.; Mayne-Bradford, 1 mi.; Urbana-Wayne, 1 mi.; Thurston-Campbell, ¾ mi.; Addison-Goodhue, 1 mi.; Avoca-Wallace, ½ mi.; Bradford-Wayne, ¼ mi.; Cameron-Canisteo, 1 mi.; Canisteo-Bennett's Crk., ½ mile; Corning-Chemung, 1 mi.; Greenwood-Bennett's Crk., 1 mi.; Jasper-Milwaukee, 1 mi.; Pultney-Boyd Hill, ½ mi.; Rathbone-Hedgesville, ½ mi.; Woodhull-Tuscarora, 2 mi.

L. I., Mineola—Bd. of Supvrs. has distributed the $600,000 appropriation in budget for county road maint., impvt. and constr. as follows: Hempstead, $300,060; No. Hampstead, $148,800; Oyster Bay, $117,780 Glen Cove City, $33,360.

Ohio, Akron—Summit County may expend $1,000,000 for road and bridge improvements during 1919. Announcement made by County Surveyor.

Ohio, Cincinnati—City considering following street improvements during 1919: Harrison Ave., 14,200 yds., granite paving; $87,965; Hamilton Ave., 21,500 brk., $90,000; Jones street, 2,900 bithu., $20,352; Grand Vista Ave., 1650 conc., $5,684; Elnore Pl., 1400, bit. macad., $6,339; Haven St., 2,460, conc., $14,893; Turrill St., 3,000 asph., $19,169; Verdin Ave., 3,350, brk., $16,989; Verne Ave., 4,040, brk., $22,000; Davey Ave., 1,950, bit. macad., $7,500; Davoran St., 820, conc., $5,000; Minion Ave., 2,750, conc., $12,500; Gilsey Ave., 1,750, bit. macad., $10,000. Total expendt. of $990,588.

Ohio—Cleveland—Ord. passed to issue bonds in sum of $1,000,000 to pay city's portion of expense of paving, repaving, resurfacing or improving certain streets in city, roads, thoroughfares and avenues.

Ohio, Dayton—County Commrs. announce that Eaton pike and Cincinnati pike will be paved entire length with brick, next spring.

Ohio, Lakewood—City will expend $1,256,000 on street improvements during 1919. Paving will include Marlowe, $16,350; Morrison, $10,000; Shaw, $12,600; Woodford, $12,700; Rio, $6,000; Andiner, $31,700; Belle, $26,500; Carabel, $36,840; Idlewood, $9,350; Clifton Blvd.—Highland Ave. to Rocky River, $473,000; Madison, $306,000; Detroit Ave., extension, $15,000; Chesterland, $15,000; Olive, grading, $4,000; total, $993,540; balance will be expended on sewers, water mains, etc., etc.

Ohio, Lima—Council considering placing before voters at August primaries, proposition of issuing bonds in sum of $125,000 for bridges and $75,000 to $100,000 for roads and streets.

Ohio, Toledo—Work of bldg. road on Door St.—city limits to Reynold's corner, will probably begin in Spring. Est. cost, $87,000.

Ohio, Wooster—Co. Commrs. will improve Lincoln hwy., west of here and 5 miles of Wooster-Creston road early in the Spring. $125,000 for Lincoln Hwy. and $98,000 for Wooster-Creston road.

Okla., McAlester—Resolutions adopted at public meeting endorsing suggestion of Governor-elect J. B. A. Robertson for a $30,000,000 bond issue for permanent hwys. sys.

Okla., Tulsa—Tulsa County Commrs. contemplate constr. of 108 miles of hard-surface roads to cost $1,750,000. First project will be from Tulsa to Sand Springs—7 miles; second, Tulsa to Jenks—11 miles. Capital Issues Committee has authorized issuance of $700,000 bonds of above amt. Dan Patton, associated with T. C. Hughes, Tulsa. Consit. Engr., will supervise construction.

Ore., Astoria—Construction by state aid of improved hwy. from Cathlamet down to east bank of Columbia River to ocean beach, is project now under consideration. Hwy. Comr. Jas. Allen, Frank Terrance, Goods Rds. Advocate of Aurelia, Wash., and others have inspected route for proposed highway. State of Washington may levy one mill road tax raising abt. $2,500,000 and the legislature plans to double the auto licenses, thus raising abt., $4,000,000 additional for highway improvements.

Ore., Astoria—State Hwy. Comn. has authorized paving hwy. bet. south side of Young's Bay bridge and Warrenton. $92,500 appropriated for this purpose. Contracts will be awarded in near future.

Ore., Salem—State Hwy. Comn. contemplates expendit. of $1,421,750 for road making during 1919 in that section of the state lying south of Marion, Polk and Lincoln Counties, betw. Cascade mountains and the coast, including Klamath and Lake Counties. J. C. McLeod, Div. Engr. of the Department.

Ore., Salem—State Hwy. Engr. Herbert Nunn will prepare plans and specifs., and call for bids on various constr. projects in several counties of the state. Proposed expendts. are estimated at $3,525,200.

Pa., Erie—City planning extensive street and sewer improvements, for which over half a million dollars will be needed, including repaving of state street in different sections from 12th to Turnpike, and from Second St., to the public dock; paving of 31st St.—Ash St. eastward to Penn. Ave., also paving Reed, Wayne, Perry East Ave. and Penn. Ave., from 28th St. to 31st St. Streets leading to Academy high school, Holland, French and 29th Sts., will also be paved.

Pa., Pittsburgh—City planners are requesting $12,000,000 for purpose of improving various streets in city.

Pa., Uniontown—Fayette County will sell $94,000 bonds for the purpose of bldg. and improving roads. H. Kissinger Co., Controller.

Pa., Coatesville—City considering issuing $130,000 bonds for improving various streets. W. Harry, City Engr.

S. C., Columbia—Mayor H. J. Blalock heartily endorses plan for bond issue in sum of $25,000,000 for construction of a system of permanent roads.

S. D., Pierre—State Hwy. Comn. has secured government approval of hwy. projects in state to amt. of $429,966.

Tenn., Jonesboro—Washington County Commrs. considering constr. of road betw. Carter and Greene County line. Total est. cost, $300,000.

Tex., Corpus Christi—Petitions circulated requesting Nueces County Commr. to call election immediately to vote on $1,000,000 road bonds.

Tex., Eagle Lake—$175,000 bonds sold. Funds will be used for bldg. roads through Colorado County. Total expendt. for road bldg., in this County, including state and fed. aid, will amount to $300,000.

Tex., Snyder—Henry E. Elrod, Dallas, will draw plans for Scurry County Commrs. for 125 miles of graveled road. $200,000 available. W. S. Adamson, County Judge.

Va., Norfolk—Among the improvements to be made this year are the following: Liberty street, So. Norfolk, to Hodges Ferry Rd., $14,000, Willoughby Rd., $25,000, Hodges Ferry Rd., $25,000.

Va., Portsmouth—$200,000 bonds will be

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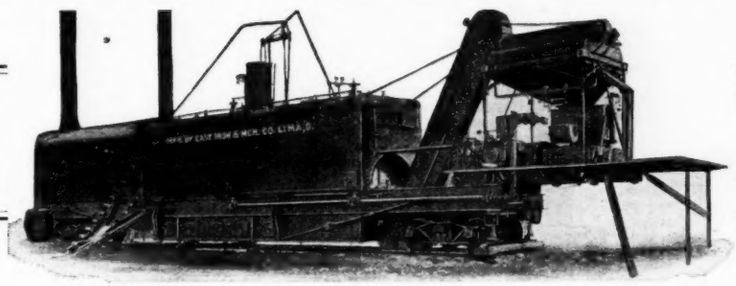

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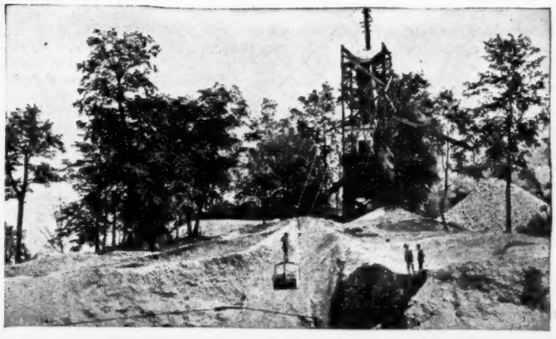

issued by Norfolk County Supvrs., for following construction: Willoughby Road, $25,000; Hodges Ferry Road, $25,000; Liberty St., So. Nolfolk, $14,000; Campostella Bridge, $50,000; Southern Branch bridge, $13,000; total, $127,000; remaining $73,000 to be used to reimburse Road Comn., for road and bridge work.

Wash., Olympia—Detail surveys and plans for federal aid projects aggregating in excess of $1,000,000 have either been completed and submitted to the secretary of agriculture for his approval, or are in process. By July 1, 1919, there will be available from federal good roads fund approx., $1,500,000 for expenditure on Washington's highways.

Wash., Seattle—City will expend $10,500,000 for municipal impvts. in 1919. These improvements will consist of grading, paving, sewer construction, water mains, etc., etc.

Wash., Seattle—County Engr. Richards, Douglas County, reports that approx. 40 miles of hwy. will be built in Douglas County this year; plans now being prepared for 7½ mi. perm. hwy. over 6 miles of which is betw. Farmer & Winthrop and 1 mi. near Mansfield. Abt. 30 miles will be graded under Donahue Road Law, at cost of $6,000 per mi. Permanent hwy. work will cost abt. $40,000. This work is in addition to considerable rd. improvements to be undertaken in Douglas Co. by State Hwy. Comn. Total est. cost of work abt. $250,000.

W. Va., Ripley—Jackson County Commrs. considering $800,000 bond issue for construction of 75 miles of road.

W. Va., Wayne—Wayne County Commrs. plan $1,000,000 expendt. for constr. of roads, bridges, abutments and fills. Howard A. Levering, Wayne and Ceredo, W. Va., is Engr.

Wis., La Crosse—Approximately $152,000 will be expended for good roads in La Crosse County during 1919.

Wis., Milwaukee—Largest and most important improvements planned for next year, in this city, are the construction of the boulevards on Oklahoma Ave., Lake street and 35th street.

SEWERAGE AND SEWAGE TREATMENT.

Ala., Sheffield—City considering construction of 1½ miles storm sewers. R. A. Chapman, City Engr.

Ariz., Douglas—Olmsted & Gillelen, 1112 Hollingsworth Bldg., Los Angeles, have been retained by City as engineers for new sewer system. City will call election in February to vote on bonds for the new municipal storm drain system which is estimated will cost abt. $100,000.

Ariz., Flagstaff—City Council has undertaken to work out plan for financing and constructing sewer system for city.

Cal., Fresno—City plans to issue $200,000 bonds to build main trunk sewer line in North Fresno. About 1100 acres will be affected by this plan. C. Murray, City Engr.

Cal., Los Angeles—City contemplates installing vitr. or cement pipe sewer, brick manholes, junction chambers, lamp holes, etc., in 29th street. Est. cost $140,250. W. T. Knowlton, Sewer Engr.

Cal., Los Angeles—Capital Issues Comm. has approved issuance of $150,000 bonds for Bairdstown Sewer District. Plans practically completed by the Los Angeles Engr. Dept. No bids taken on this project as yet.

Cal., Redwood City—Plans being prepared for enlarging outfall sewer and constructing septic tank. A Dimmitt, City Engr.

Cal., Turlock—City Trustees preparing for constr. of sewage disposal system for Turlock. Imhoff tank with filtr. beds is proposed. Engr. Jensen, Fresno, in charge of the work. Bonds will be voted.

Conn., Bridgeport—Sewer Committee has filed report with City Auditor Keating of proposed work for 1919, as follows: Black Rock storm sewer, $71,800; Bay street sanitary interceptor, $17,100; East Washington avenue combined, $6,300; Island Brook avenue and River street, $25,000; Railroad court extension, $18,000; Spring street, $25,000; Wood avenue and Hillside avenue, $15,500; sewer wells, $8,000.

Conn., New Canaan—Town Selectmen plan to replace present sewer system with a modern system.

Ct., New Haven—Dr. Geo. H. Joslin recommends that sewers be built; system will cover five miles and cost abt. $25,000.

D. C., Washington—District Commrs., 427 District Bldg., considering construction of sewers. $585,000.

Fla., Sarasota—$45,000 bonds voted by City for sewer and water works construction. Paul Thompson, City Clk.

Ga., Lagrange—City will issue $70,000 bonds for sewer construction and paving.

Ida., Boise—City Council having surveys made for proposed sewage displant. C. C. Stevenson, Boise, Engr.

Ill., Chicago—Plans being prepared by Langdon Pearse, Engr. for Sanitary District, for intercepting sewer and sewage treatment plant to be erected on a site of 26 acres near Maywood. Est. cost, $800,000. Plant will include a one and two story bldg.; pumping station to be of brick, conc. and steel constr. Erection of pumping station at Blue Island also being considered by District.

Ill., Staunton—Bd. Local Impts. plans to construct sanitary sewer in various streets. Abt. 110,000.

Ind., Terre Haute—City contemplates bldg. sewers in various streets, involving one mile 12-36 in. conc., vitr. or segments, block pipe, etc. Abt. $30,000. R. A. Koerner, City Engr.

Ia., Marshalltown—City will ask bids early in Spring for constr. of storm sewers in several streets. Total est. cost $30,000. O. G. Hern, City Hall Engr.

Ia., Iowa City—City engineer has submitted estimates for proposed sewer, 1 mile in length; 6656 ft. 18-in. vitr. pipe, starting on bank of Iowa river, $27,000.

Kans., El Dorado—City Manager Wells preparing plans in accordance with which the City Commrs. may introduce required legislation for new sewer district, which will extend from Kansas avenue to Towanda avenue and from Main street to Denver street. This will embrace what is known as Adams Second Addn. to El Dorado; together with Adams Annex. Work will require laying abt. three quarters of a mile 12-in. sewer pipe which will be connected to smaller laterals throughout the district. Est. cost not yet determined.

Md., Baltimore—City will expend $75,000 for maintenance and improvement of storm water sewers; $33,326 for extension of sewer system to Locust Point.

Md., Crisfield—Plans for constr. of sewers and disposal plant. Total est. cost $100,000. Norton, Bird and Whitman, Engrs., Munsey Bldg., Baltimore, Md.

Mich., Detroit—City considering constr. of trunk line sewers in Linwood and Lonyo Roads, for purpose of serving newly annexed territory. Est. cost, $7,500,000. C. W. Hubbell, City Engr.

Mich., Pontiac—City has obtained estimate of cost of installing Imhoff tanks to replace present sewer system which empties into Clinton river. Approx. cost, $225,000. Bonds to be submitted at election in Spring or Summer.

Minn., Keewatin—Village will retain J. H. Dohm, Civil Engr., Duluth and Hibbing, to prepare plans and specifs. for new sewage disposal plant.

Minn., Morris—City plans to build 6,000 ft. 10-15 inch tile sewers in various streets. O. G. Hern, City Hall, Engr.

Minn., Winnebago — Village considering constr. of sewer system—about 30 blocks. $60,000. 38,930 lin. ft. 10 to 36-in. vir. clay pipe, 59 manholes, 140 intakes. C. H. Currie, Webster, Ia. Engr.

Mo., St. Louis—Included in list of needed improvements submitted by Harland Bartholomew, Engr. of City Plan Comn., are the following sewers; outlets along river, $200,000; extensions North Baden, $300,000; Harlem, $225,000; Wherry, $120,000; Relief, Mill Creek laterals, western extension, $1,100,000; Ohio-Montrose, $400,000; Rock Springs, $125,000; Camp Springs, $550,000; Compton avenue, $300,000; Rocky Branch, (city's share), $425,000; southern Arsenal (city's share) $1,100,000; Ferry street (city's share), $60,000; additional street inlets, $150,000; reconstruction of wornout sewers, $600,000.

N. Y. City, Queensboro—Petition for constr. of sewer in Remsen place—Grand Street to Perry Avenue, Maspeth, approved; also petition for constr. of sewer basins, sewer manholes, etc., in 19th street—Ave. C to Ave. D, College Point; also similar work in Peartree Ave.—Pell street to Kingsland avenue, Corona.

N. Y., Rochester—City will soon receive bids for 9,000 ft. 24-in. tile sewer to be laid in bed of old Erie canal from Washington avenue to Church street. L. E. Sebring, City Engr.

N. Y., Tonawanda—Daehl, Engr., preparing plans for city laying 8 and 10-in. vitr. tile sewers in Edgar, Riverside, Roswell, Huetter, Weber, also Tonawnda streets, at about $30,000.

N. Y., Yonkers—Authorization given Board of Aldermen for constr. of an extension to Herriot street sewer under revised plan submitted by City Engineer Griffith.

Ohio, Akron—Preliminary plans for sewer district to serve what is known as "Glenwood Ave. Distr.", N. Hill, prepared by J. E. Root of City Engineer Zeisloft's Dept. Est. cost $105,000. Total length of sewers recommended is 13,420 ft; size varying from 12 ins. to 51 ins. District to be drained takes in N. Howard street, Chalker avenue, Berwyn street, Mildred axenue, Dayton street, E. Talmadge Ave., Lookout avenue, Julien avenue and West Charles street.

Ohio, Cincinnati—Capital Issues Comm. has approved of Street and Sewer bonds to amt. of approximately $1,000,000 for this City.

Ohio, Cleveland—Ord. passed to issue bonds in sum of $1,000,000 for paying city's portion of expense for constructing sewers in various streets in City.

Ohio, Lakewood—City will expend $154,000 for construction of intercepting sewer—river to Webb street; also $17,300 for sewers in Olive, Hilliard to Margaret streets.

Ohio, Vermilion—County Engr. Schultz will have sewer and paving plans of an extensive character ready for contractors early in February. Plans include brick paving to cost $40,000. Mr. Gascoign, Cleveland, Conslt. Engr.

Ohio, Warren—City will take bids soon for bldg. sanitary sewer system in Northeast and Southwest sewer districts. Abt. $150,000. C. H. Lawrence, City Engineer.

Okla., Tulsa—City has issued $40,000 bonds for sewer extension. C. H. Hubbard, Mayor.

Okla., Covington—$80,000 bonds to be issued by City for purpose of constructing sewer and water system.

Ore., Astoria—Plans for constr. of a complete sewer system in Taylor's Addn., approved by City Council. Extensive system, embracing whole of this district, outlined by Deputy City Surveyor Alfred Tee, and adopted by City Council.

Ore., Portland — Largest undertaking planned for construction in this City during 1919 is the Peninsula district sewer system; first unit of which will cost abt. $750,000, with an ultimate cost of $3,000,000. This unit will serve Kenton, Piedmont, Alberta and Portsmouth districts; other sewers planned for immediate future are in Gilsan street—10th street to the river; Quimby street and eight or ten smaller sewers.

Pa., Allentown—City Council has decided to expedite preliminary legislative details of proposed downtown intercepting sewer. Est. cost of sewer, betw. $200,000 and $300,000; first unit already installed.

Pa., Meadville—Council has authorized purchase of Geo. Bosler farm as site for sewage disposal plant.

Pa., Philadelphia—Main and branch sewers to cost abt. $3,000,000 will be built in various sections of city. Plans and specifications being drafted by Bureau of Surveys. Work will be started by Dept. of Public Wks., particularly on branch sewers for which there is $1,200,000 available, as soon as Capital Issues Comm. removes restrictions on loan funds.

Tex., Laredo—F. A. Jones, Engr. & Constr. Co., Dallas, preparing plans for sanitary sewer system. Est. cost bet. $109,000 and $200,000.

Tex., Dallas—City Commrs. have authority of Capital Issues Comm., Washington, to issue $200,000 storm sewer bonds.

Wash., Seattle—Specifications prepared for sewers in Hinds street at est. cost of $28,000. Approx. quantities: 5,900 ft. 12-in. sewer pipe, 490 ft. 15-in. sewer pipe, 370 ft. 21-in. sewer pipe, 655 ft. 30-in. sewer pipe, 960 ft. 12-in. wood stave pipe, 270 ft. 30-in. wood stave pipe, 28-4½ ft. manholes, 10 flush tanks.

Wash., Seattle—Plans & specifs. presented for sewers in 44th Ave.; 6,180 ft. 8-in. sewer pipe; 2400 ft. 10-in. sewer pipe; 3160 ft. 12-in. sewer pipe; 640 ft. 8-in. wood stave pipe; 880 ft. 10-in. wood stave pipe; 2160 ft. 12-in. wood stave pipe, etc. Approx. cost $54,000.

Wash., Seattle—City will expend $10,500,000 for municipal improvements in 1919. Included are sewers in various streets as follows: Meridian and others, $3,932; 40th Ave., N. and others, $26,979; First Ave., N. E., and others, $4,708; W. 74th St., $4,606, etc.

Wash., Spokane—Plans being prepared for constr. of an intercepting gravity sewer in downtown district. Work involves 4,000 ft. 30-33 in. rein. conc. pipe and approx. 25,000 cu. yds. rock and earth excav. Est. cost, $200,000. A. B. Butler, City Engr.

Wis., Kenosha—Sewer and water mains

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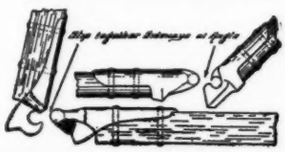

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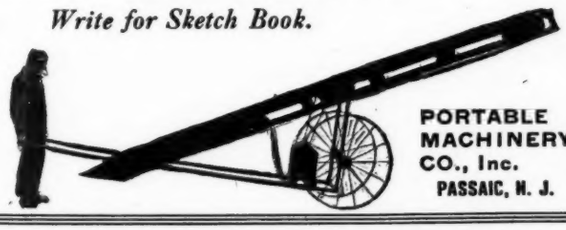

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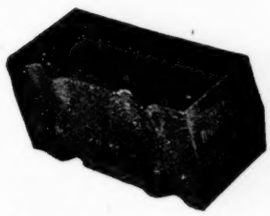

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SPRINGFIELD, ILLINOIS

contemplated for various locations will cost about $60,000.

Wis., Milwaukee—City will expend on work in connection with sewers, abt. $405,000; of which sum abt. $160,000 will be needed for earth-basin constr. work. Dakota street tunnel and Rush avenue outlet means an expendt. of abt. $90,000 and abt. $50,000 for minor work.

WATER SUPPLY AND PURIFICATION.

Ala., Mobile—Mobile County Commrs. will drill artesian well on court house grounds; plan to install complete water system for courthouse if sufficient water is obtained.

Ark., Prescott—City considering reconstr. of distributing system and constr. of new water works system, including storage reservoir, distributing reservoir, canal, headgate and supply pipe line. Total est. cost, $300,000. H. Phillips, Internal Life Bldg., St. Louis, Mo., Consit. Engr.

Ariz., Florence—Plans being prepared for new municipal water works and lighting impvts. Est. cost $80,000. Burns & McDonnell, Consit. Engrs., Kansas City, Mo.

Cal., Los Angeles—Steps taken by public service commission for constr. of power plant No. 2 in San Francisquito canyon. Cost, $1,250,000. Will add 28,000 H.P. to city's aqueduct power resources. E. F. Scattergood, Chf. Engr., Municipal Power Bureau; Wm. Mulholland, Chf. Engr. of Aqueduct. Plans and estimates of cost by E. F. Scattergood. Construction work will start at once.

Cal., Los Angeles—City contemplates constructing water system for supplying water from Los Angeles aqueduct to Western Annexed District. Approx. expendt., $600,000. W. Mulholland, Chrmn. Engrg. Board of Public Service.

Cal., Sacramento — City contemplates constr. of new pure water system to cost about $1,250,000.

Waterbury, Conn.—City considering laying water mains, Cherry street to Waterville. $125,000 to $150,000. R. A. Cairns, Engr., City Hall.

Ill., E. Alton—Sheppard & Morgan, Archts., Edwardsville Bk. Bldg., Edwardsville, preparing plans for water works distribution system for City. Est. cost abt., $65,500.

Ill., Hillsboro—City Engr. Warren has presented plans to Commrs. for extending water mains on every street in town.

Ill., Witt—Plans prepared for constr. of distribution system to cost approx. $80,000. Miller & Holbrook, 418 Milliken Bldg., Decatur, Ill.

Ia., Clarinda—Plans being prepared for water works improvements, for which bond issue of $75,000 was voted Dec. 6. Burns & McDonnell, Consit. Engrs., Interstate Bldg., Kansas City, Mo.

La., Monroe—Capital Issues Comm. has approved issuance of $100,000 bonds for filtration plant.

Md., Baltimore—Following amounts appropriated by Water Dept. for expendt. during 1919: $100,000 for 30-million gal. pump at Mt. Royal Pumping Sta.; North Ave. & McMechen St.; $7,500 for turbo generator to be used in motorization of auxiliary units in Mt. Royal station, and $26,000 for operating tables in Lake Montebello filtr. plant, Rarford Ave. W. F. Lee, Engr.

Md., Brunswick—D. L. Spitzer, City Clk., will ask bids abt. Feb. 10, for trenching and laying 5 miles 4-10 wood stave pipe from springs in London Co., Va., gravity flow; also enlargement and impvt. of reservoir. Abt. $126,000. Norton, Bird & Whitman, 1320 Munsey Bldg., Baltimore, Engrs.

Md., Princess Anne—Town Commrs., will construct water distribution system. Est. cost $60,000. L. J. Houston, Fredericksburg, Va. Engr. Columbus Lankford, Pres.

Mo., St. Louis—Preliminary plans prepared for extension of water works system on Missouri River near Creve Coeur Lake; $20,000,000 bond issue recommended. H. Bartholomew, City Engr.; E. E. Wall, Water Commr., 312 City Hall.

Mo., Kansas City—Plans for constr. of proposed new pumping station to take the place of one at Quindaro, are being completed by W. G. Goodwin, Supt. Ch. Engr. of water plants of city.

Mo., St. Louis—Preliminary plans prepared for constr. of an addition to the water works system on the Missouri River, near Creve Coeur Lake. E. A. Wall, 312 City Hall, Water Commr.

Minn., Duluth—Water main extension contemplated for Smithville and gas extension for Morgan Park. Total cost $65,000. F. G. Phillips, Comr. of Utilities.

Mont., Havre—$75,000 bonds voted by city for extension and improvement of water works system.

N. J., Wharton—Bids will be taken in February for bldg. water works system. A. Potter, 30 Church St., New York City, Consulting Engr. Est. cost $150,000.

Ohio, Norfolk—At election in Bellevue it was decided to issue $135,000 bonds for constr. of fourth water works reservoir with capy. of one hundred million gallons.

Okla., Ada—City plans election to vote on $90,000 bonds for improvement of water works. Benham Engineering Co., 1300 Colcord Bldg., Okla. Engrs.

Ohio, Cleveland—Director of Utilities Farrell, announces that city will start bldg. $3,500,000 East Side filtr. plant within six months; plant to be erected at Kirkland pumping station.

Ore., Salem—Town of Hillsboro has filed with State Engr. Percy A. Cupper, petition for water system to cost $125,000 and which will include a pipe line 17 miles long. Permission is asked to appropriate eight second ft. of water from east fork of Dairy Creek for purpose of increasing the water supply of Hillsboro and adjoining communities.

S. Dak., Mitchell—Plans for improved water works plant, submitted by Kansas City engrg. firm, are awaiting approval of City Engr. S. Smith. Est. cost $71,000. It is expected construction will begin in Spring. 5 new soft water wells will be sunk. Plant will consist of modern pumping station, 48 by 100 ft., will be equipped with a 125 h.p. boiler; new pump will be added to increase pressure needed for fire protection, etc., etc.

Tex., Dallas—City considering election in April to vote on $3,000,000 bonds to construct reservoir. G. D. Fairtree, City Engr.

Tex., Hillsboro—City has voted in favor of issuing $40,000 bonds for water works.

Va., Portsmouth—Ord. passed by Council providing for issuance of bonds in sum of $2,700,000 for purchase of Portsmouth, Berkley & Suffolk Water Company's plant.

Wash., Seattle — Special committee (Mayor, Corp. Counsel & Chrmn. Finance Comm.) authorized to apply to Capital Issues Comm. for approval of issuance and sale of $500,000 of the $3,700,000 utility bonds heretofore authorized for water extensions. Resolution asking for approval of $750,000 utility bonds for power & light extensions also introduced to Finance Comm.

Wash., Seattle—City will expend $10,500,000 for municipal improvements. Included are the following amounts for water mains in various streets: 13th Ave., S. W. and others, $105,030; 38th Ave., N. W. and others, $5,595; Beacon Ave., $4,267, etc.

Wash., Spokane—City plans to install steel and iron headgates with operating devices at Upriver pumping plant to replace old timber headgates on masonry dam. Est. cost, $30,000; also replacing 6 miles wooden water pipes with 6-in. steel mains. Will purchase equipment and install same by day labor. A. Lindsay, Supt.

BRIDGES AND BUILDINGS.

Ark., Glenwood—Plans being prepared by Burnham Engrg. Co., Glenwood, for conc. bridge over Caddo River, Pike County, Murfreesboro, Ark. Est. cost $45,000.

Cal., San Diego—Work on steel and concrete bridge to span San Diego river will be started next April. Structure will be 400 ft. long and will cost about $50,000.

Del., Wilmington—Levy Court has instructed Co. Engr. Chas. E. Grubb to secure services of consulting engineer relative to Washington street and Market street bridges over the Brandywine. Bills to be prepared to be presented to the Legislature relative to financing constr. of the two brdgs.

Ida., Boise—State Hwy. Comm. will cooperate with Homedale hwy. distr., and canyon county in constr. of bridge across the Snake River at that point, the state to bear one-third of the expense. Amt. must not exceed $10,285 as state's share in the constr.

Ida., Wallace—Shoshone County Good Rds. Assn., decided to join with Kootenai in construction of new bridge at Cataldo Plans also call for bldg. approaches at same time as to make rdway and brdg. conform in every way to national hwy. standards. Est. cost of bridge, $27,000; total cost of bridge and approaches, $32,000.

Ia., Cedar Rapids—Council authorized to secure estimates and plans for bridges across river at First Ave., $250,000.

Ia., Davenport—Plans being prepared for constr. of 10 or 15 bridges and several culverts in Scott County. Est. cost $30,000. A. A. Ryan, Engr., 4th & Ripley Sts.

Ill., Chicago—Sanitary District has been authorized by the Legislature and court decisions to proceed with constr. of three bridges across the drainage canal at Crawford, Cicero and Harlem avenues, in connection with the erection of pumping station at Blue Island. Est. cost of bridges $800,000.

Ill., Georgetown—Plans being prepared for Vermillion Co., Hwy. Comm., Danville for constr. of bridge having four 55-ft. spans to cost approx., $20,000. A. Dillon, Engr.

Ia., Des Moines—City considering constr. of a concrete bridge 1,000 ft. long and 40 to 50 ft. wide. Est. cost $300,000. K. C. Kastberg, City Engr.

Mass., Boston—Metropolitan Park Comn. has recommended appropriation of $170,000, making total of $500,000, for rebldg. bridge over Neponset river betw. Boston and Quincy.

Mass., Boston—Rep. Jas. H. Brennan has filed with Clk. of the House, a petition for constr. of suspension brdg. betw. Boston and East Boston, structure to be memorial to Boston men who served in war. Cost of brdg. will be met by bond issue of $1,000,000.

Mass., Chelsea—Mayor Willard has filed petition with clerk of House of Representatives asking that his city be permitted to borrow $120,000 to pay for work on bridges betw. Boston and Chelsea.

Mich., Grand Haven—State of Mich. will build bridge across channel into Spring Lake at Ferrysburg. It will have a draw 62 ft. wide. Est. cost betw. $40,000 and $50,000.

Miss., Cleveland—$50,000 bonds voted for construction of bridge over Sunflower River.

Mo., Jefferson City—Cole County Commrs. considering constr. of suspension bridge over Osage River at Hohman's Ferry. Est. cost $12,000.

Nebr., Central City—Merrick Co. and Hamilton Co., considering constr. of 1,060 ft. streel and conc. bridge over Platte river, south of city; also fill or dyke work in connection. State aid project. $65,000.

N. Y., Albion—Town of Carlton has voted in favor of $30,000 bonds as its share of expense for constr. of new bridge across Oak Orchard creek in Village of Waterport. Total est. cost of bridge $60,000.

Ohio, Columbus — Franklin County Commrs. have decided to construct bridge over Scioto river at Greenlawn avenue. Walks will be of extension plan, extending beyond the abutments of bridge like flanges of letter "T." Est. cost approx., $100,000.

Ohio—Toledo—City will expend $191,750 for bridge work in connection with extension of Summit street across Swan Creek. H. A. McClure, City Eng.

Ore., Salem—Numerous bridges are to be designed by the bridge dept. of State Hwy. Comn., during 1919. L. W. Metzger, designing brdg. engr., Salem Bank of Commerce Bldg., reports that plans are to be prepared for a $75,000 structure to span the Deschutes river betw. Moro and Sherman Cos. It will be 850 ft. long, with 7 reinf. conc. arches; another brdg. will span the John Day river betw. Sherman and Gilliam Cos.—two 126-ft. wood deck spans constructed on conc. piers, $20,000; 600 ft. trestle will be built near Newberg, plans for which are now prepared. Largest structure contemplated is bridge to be constructed across Williamette River to Oregon City. A bridge to cost $200,000 will be built.

Pa., McKees Rock—Commrs. Allegheny County (Pittsburgh) have preliminary plans prepared by J. G. Chalfant, Engr., City-County Bldg., Pittsburgh, for bldg. steel bridge over Ohio River from here to lower North Side. Est. cost abt. $2,600,000.

Pa., Pittsburgh—Commrs. Allegheny Co., having preliminary plans prepared by J. G. Chalfant, Engr., City-County Bldg., for bldg. steel bridge over Allegheny River from 16th Street to North Side; also steel bridge over Allegheny River from 40th street to Millvale. Abt. $1,000,000 and $1,250,000 respectively. City will bear part of cost.

Pa., Philadelphia—City will expend $10,000,000 for extensive improvements. Plans and specifs. completed. Included are 12 bridges, and continuation of the work of eliminating grade crossing in South Philadelphia. $725,000 available for constr. of new bridges; $6,000,000 for the grade crossing work.

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CHICAGO, ILL.

Pa., Reading—Change has been made in Bingaman street bridge plans. Bridge will be 60 ft. wide, with 24-ft. hwy. to south of bridge approach. Co. Engr. Sanders will now proceed to make necessary alterations to plans and it is hoped county will soon be in position to ask for bids for erection of bridge.

Utah—Commrs. Cache Co., plan to build 125-ft. steel brdg. with approaches over Blacksmith's Fork River at mouth of Blacksmith's Fork Canyon. Abt. $100,000; also plan to build 110-ft. steel brdg. on conc. piers and 125 ft. steel brdg. with approaches over Bear River here. Abt. $10,000 each. T. H. Humphreys, Co. Engr.

Va., Portsmouth—$200,000 bonds will be issued by Norfolk County Supvrs., for bridge and road construction; including Campostella bridge, $50,000; Southern Branch bridge, $13,000.

Wash., Seattle—County Engr. Samuel Humes has begun preparation of plans covering constr. of what will be known as Lee Hill bridge at Auburn. Bridge will cross Green River at Auburn. 150-ft. steel span will rest on conc. piers; heavy timbered approaches.

Wis., Appleton—14 bridges will be constructed in 1919; conc. constr. Town of Liberty, 4; Osborne, 5; Black Creek, 2; Ellington, 3.

Wis., Green Bay—Construction of 40 bridges being considered; various locations; private plans. Geo. J. Cormier, Comr. Hwy. Comn., Brown Co.

DRAINAGE AND IRRIGATION.

Ariz., Phoenix—City contemplates constr. of draing. sys., to lower ground water level in city, involving 10 mi. various sizes tile pipe and 150 manholes. Est. cost, $150,000. H. Phillips, Consit. Engr., International Life Bldg., St. Louis, Mo.

Cal., Escondido—Report of State Engr. on San Luis Rey irrig. project, submitted to water comm. of district. Plan is to take water from San Luis Rey river at Warner's dam to irrigate 43,000 acres lying betw. here and Oceanside. Est. cost of project complete is as follows: Land, including 6,050 acres of Warner ranch for reservoir and right-of-way for 33 mi. to distributing reservoir, $972,575; main supply conduit, dam to district, $1,106,931; Warner's dam, 107 ft. high, $614,762; distributing reservoir $214,715; distributing system, $1,310,546; water rights, $1,075,000.

Cal., Sacramento—Following applications for permission to appropriate water submitted to State Water Commission: Herman G. Wilday, Palmdale, 2 cu. ft. per second of waters of unamed spring, Los Angeles Co. for irrig., 130 acres; pipe line ½-mile long; R. H. Gilman, Los Angeles, 10 ins. water, Layton canyon for mining; est. cost $3,000; Wm. E. Cook, Atolia, approx. 3 ins. water, canyon spring, Kern Co. for use on 120 acres; shaft and pipe line one mile long; W. E. Pierce, Auld, 3 cu. ft. per second, Riverside County, irrig. 200 acres; conc. dam 4 ft. high, 15 ft. long on top and 12 ft. long on bottom, and 12-in. pipe line 1 1-3 mi. long. Est. cost $3,500; Oakdale Irrig. Dist., Oakdale, 125,000 acre ft. per annum, Stanislaus River, Calaveras & Tuolumne Cos., irrig. purpose; water to be stored in reservoir on Stanislaus River; storage dam across stream 200 ft. in height. Est. cost, $2,000,000; Dudley Moulton, San Francisco, 2,000 cu. ft. per 2nd, Pitt River, Shasta Co., tributary to Sacramento river; for develop. hydro-electric power, dam 185 ft. high, 600 ft. long on top and 80 ft. long on bottom; conc. masonry. Est. cost, $1,250,000; Dudley Moulton, San Francisco, 500 cu. ft. per 2nd, Pitts River, Shasta Co., to develop hydro-electric power; dam 150 ft. high, 800 ft. long on top and 100 ft. long at bottom; reinf. conc. and masonry. Est. cost $1,500,000.

Cal., Sacramento—Fair Oaks Irrigation Dist., Sacramento County, has sold $100,000 of the $200,000 bond issue approved by State Bond Comn. Funds will be used for extension work in district along Robertson system.

Fla., Miami—Southern Drainage District has issued $1,450,000 bonds for draing of 140,000 acres Everglades lands west of here. Geo. T. Morgan, Secy.

Idaho—Camas — Camas Mutual Irrig. Distr. has voted $675,000 for constr. work on its canal and reservoir system. Total of 20,637 acres will be brought under irrigation.

Ia., Oskaloosa—Plans have been prepared for Bear Crk. ditch, Poweshiek Co. Main ditch, 11.72 mi., bottom width 14 to 16 ft. average depth 8 ft. involving 330,000 cu. yds., excav., 2.3 mi. long; 14 ft. wide at bottom, 8 ft. deep; slope ½ to 1, involving 65,000 cu. yds. excav. Ready for bids abt. April 1st. T. L. Blank, City Engr.

Kans., Marion—Proposed impvts. in Cottonwood Valley Drainage Dist., of Marion County, will probably be ready for bids in February. This is a flood protection project requiring cut-offs in 3 rivers and clearing out old channels for total length of 29,200 ft., requiring 900,000 cu. yds. excav. Tuttle-Ayers-Woodward Engrg. Co., 307 Reliance Bld., Kansas City, Mo., Engrs.

Minn., New Ulm—Plans prepared for constr. of Judicial Ditch, Lyon & Yellow Medicine Cos. Main ditch 25 mi. long; total excav., 2,750,000 cu. yds. Est. cost, $745,360. F. D. Minium, Engr.

Mo., Cape Girardeau—Little River Draing. Dist. contemplates constr. of 50 miles of ditches; excavating required—14,400 cu. yds. Est. cost $250,000. 40,000 acres, Stoddard & Bollinger Cos., Mo. B. F. Binns, 410 H. & H. Bldg., Cape Girardeau, Mo.

Mo., St. Joseph — Draing. Dist. will straighten One Hundred and Two River, 17½ mi. dredge-boat ditch. Est. cost. $180,000; 9088 acres in Distr. W. B. Hazen, Engr., Commercial Bldg., St. Joseph.

N. J., Trenton—Appropriation of $2,000,000 made ofr greater develop. of Delaware River Channel betw. this city and Delaware Bay.

Ore., Baker — Bridgeport-Durkee Irrig. District, Baker County, contemplates constr. of reservoir on Burnt River, to supply water to 6,000 acres. L. R. Stockman, Baker, Engr.; Medical Springs Irrig. Dist., considering constr. of canal system from Catherine Creek, to irrigate 4,000 acres; North Fork Irrig. Dist., contemplates constr. of reservoir on No. Fork Burnt River, and canal system to irrigate 4,000 acres; L. R. Stockman, Engr.; Unity Irrigation Distr.. considering constr. of rsservoir to irrigate 3,000 acres in district of Burnt River. L. R. Stockman, Engr.; plans being prepared for system to irrigate 14,000 acres from Eagle River for Sparta Irrigation District. R. Luper, La Grande, Ore., preparing plans.

Ore., Eugene—Benham Falls Irrig. Co., considering bldg. system to drain and irrigate 82,349 acres; water to be taken from McKenzie River. Approx. expendt., $1,235,000. A. Cupper, State Engr.

Utah, Springville—Utah County Draing. Dist. No. 1, will vote on bond issue of $90,000 for constructing drainage canals, etc. L. T. Epperson, Co. Clk.

Wash., Yakima—R. K. Tiffany, project mgr. of the Reclamation Service, Yakima Valley, has requested W. P. Davis, Director of the Service, for $3,000,000 to develop the irrigation systems in valley during 1919. Of the 1919 appropriation $1,000,000 will be expended on Rimrock project, which was abandoned on acct. of the war. $1,000,000 will go for tunnel and work at Lake Clealum. Work surveyed and perm. constr. plan adopted. He also reports that $750,000 can be expended to advantage in Kennewick District, where Direct. Davis has already announced he will expend $250,000, for purpose of extending Sunnyside Canal. Other sums will be spent in smaller irrigation projects.

Wash., Yakima—Naches-Selah Irrigation District has voted to expend an additional $75,000 for continuing canal constr., which has already been authorized for $350,000. New tunnel will be 3400 ft. long.

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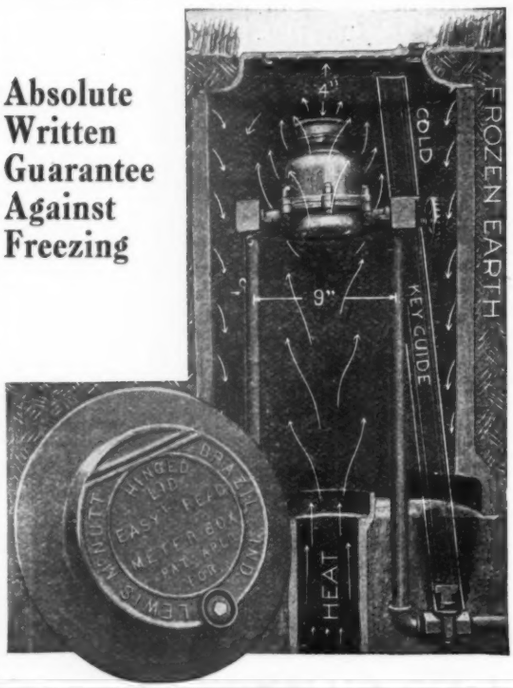

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WATER PURIFICATION PLANT FOR EAST CHICAGO

1. Sealed proposals for the construction of a Water Purification Plant in the City of East Chicago, Indiana, addressed to C. L. Kirk, Vice-President of the East Chicago & Indiana Harbor Water Company, and endorsed proposal for Water Purification Plant will be received at the office of the Indianapolis Water Company, 113 Monument Circle, Indianapolis, Indiana, until 12:00 o'clock noon Tuesday, February 25, 1919, at which place and time said proposals will be publicly opened and read.

2. All bids must be upon blank forms furnished by the East Chicago & Indiana Harbor Water Company, hereinafter referred to as the owner, and should give a price for each item of work proposed, both in words and figures, and be signed by the bidder with his business address and place of residence.

3. Each bid must be accompanied by a certified check of two thousand five hundred dollars ($2,500) payable to the order of the East Chicago & Indiana Harbor Water Company, enclosed in the sealed envelope containing the bid. All checks of unsuccessful bidders will be returned within three days after bids have been received. If all bids are rejected, all checks will be returned forthwith.

4. A bond in the sum of fifty thousand dollars ($50,000) with a surety company satisfactory to the owner as surety will be required for the faithful performance of the contract, the name of the company to be offered to be designated in the proposal.

5. The successful bidder to whom the contract shall be awarded by the owner shall within fifteen days, not including Sundays and holidays, after the awarding of the contract enter into a contract and furnish bond duly executed with a satisfactory surety company. Should the bidder to whom the contract is awarded fail to enter into the contract and to furnish bond within the time specified, the proposal and acceptance shall be null and void and the certified check accompanying the proposal shall be forfeited to and shall be retained by the owner as liquidated damages for such failure and neglect and to indemnify the owner for any loss which may be sustained by failure of the bidder to execute the contract and to furnish the bond as aforesaid.

6. The specifications for the work provide that the owner will pay monthly estimates of eighty-five (85) per cent. on the contract price of such part of the work completed during the previous month.

7. The specifications for the purification plant cover the construction of a chemical house, filter house, boiler house and pumping plant addition, sedimentation basins and filtered water reservoir. In order to give any one desiring to bid an idea as to the scope of the work, the following approximate quantities of the principal items entering into the construction of the purification plant are given:

Excavation, 16,000 cu. yds.

Concrete, 6,600 cu. yds.

Loam furnished, 2,300 cu. yds.

Reinforcing steel, 140 tons.

The handling and setting of 218 tons of cast iron pipe.

The handling and setting of 72 tons of gate valves and sluice gates.

In the above items the material entering into the construction of the super-structure of the chemical house, filter house, boiler house addition and pumping station addition are not included.

8. Bids will be received on all items mentioned in the specifications as per plans and specifications prepared by Metcalf & Eddy, Consulting Engineers, and on alternate plans for the sedimentation basin and filtered water basins prepared by the engineer of the East Chicago & Indiana Harbor Water Company. The owner reserves the right to let a contract for the entire work covered by the plans and specifications or for only a part of the work, which part will include the construction of the sedimentation and filtered water basins, the foundations of the chemical house and filter house, the construction complete of the boiler house and pumping station additions, and the construction of sewers and drains, but will exclude the construction of the super-structure of the chemical house and filter house, the handling and setting of cast iron pipe, gate valves and sluice gates, and other work more specifically enumerated in the specifications.

9. Detail contract drawings, form of contract and specifications may be examined at the office of the East Chicago & Indiana Harbor Water Company, 4735 Olcott avenue, East Chicago, Indiana, and at the office of the Indianapolis Water Company, 113 Monument Circle, Indianapolis, Indiana. Plans and specifications may be obtained from B. J. T. Jeup, Chief Engineer Indianapolis Water Company, provided a deposit of fifty dollars ($50.00) is made. The said deposit will be returned upon return of plans and specifications. The bidder must return the said plans and specifications to the owner on or before February 25, 1919.

10. The owner reserves the right to reject any or all bids or to accept a bid deemed to be for the best interests of the owner.

C. L. KIRK, Vice-President,
113 Monument Circle,
Indianapolis, Indiana.

January 25, 1919.

SANITARY TRUNK SEWER

Canton, Ohio

Sealed proposals will be received by the Director of Public Service, Canton, Ohio, until 12 o'clock noon Central Standard Time, February 14, 1919, for furnishing labor and materials required for the construction of three sections of the East Side Intercepting Sewer, according to plans and specifications on file in the Director's office.

Length of Section No. 1, 7965 feet—brick, segment block or reinforced concrete pipe.

Length of Section No. 2, 5193 feet—brick, segment block or reinforced concrete pipe.

Length of Section No. 3, 1050 feet—Vitrified Pipe, segment block or reinforced concrete pipe.

Copies of plans and specifications can be had from the Director by depositing $10, which deposits will be returned on return of same in good condition, or upon filing of bids.

Bids must be made upon the forms included in said specifications. Each bid must be accompanied by a certified check or a bond satisfactory to the Director in the sum of 5% of the total amount of bid. The Director reserves the right to reject any or all bids received and to accept any of which he may deem most favorable to the interests of the City of Canton, Ohio.

FRANK L. DE CORPS,
Director of Public Service.

W. E. SARVER,
City Civil Engineer.

ROAD WORK

Philippi, W. Va.

Sealed proposals for the construction of the following roads addressed to the County Court at Barbour County, West Virginia, and endorsed "Proposal for Construction of Class A Road in Barbour County," will be received by said Court at the office of the Clerk of said Court in Philippi, W. Va., until 1 P. M. on the 17th day of February, 1919.

The Fairmont and Beverly Turnpike—Federal Aid Project No. 16—Bituminous macadam: 14 ft. wide, 3.2 miles.

The Junior Road—Bituminous macadam, 14 ft. wide, 2.85 miles.

Plans and specifications may be seen at the office of the said County Clerk and at the office of the State Road Commission, Charleston, W. Va.

Proposals shall be submitted upon the blank forms to be provided by the undersigned and shall be accompanied by a certified check for at least 5 per cent of the total amount bid.

The right is reserved to reject any or all bids.

REFINED ASPHALT AND REFINED TAR

Montclair, N. J.

Sealed bids will be received by the Board of Commissioners of the Town of Montclair, in the County of Essex, for the furnishing and delivery to the Town of Montclair of **refined asphalt and refined tar for use in the construction of macadam pavements during the year 1919**, in accordance with specifications of the Town Engineer.

Each bidder will be required to use the form of bid on file in the office of the Town Engineer and all bids not made on such form **will be rejected.**

Each bid must be accompanied by a forfeit of five hundred ($500) dollars to insure the signing of the contract and bond by the successful bidder within two weeks after the award shall have been made.

Approximate quantity of refined asphalt and refined tar required is 100,000 gallons.

The right is reserved to reject all bids.

All bids must be filed with the undersigned not later than four o'clock p. m. afternoon of Thursday, February 13, 1919, at which time the said Board of Commissioners will meet in the Council Chamber of the Municipal Building to consider the same.

By order of the Board of Commissioners,
HARRY TRIPPETT,
Town Clerk.

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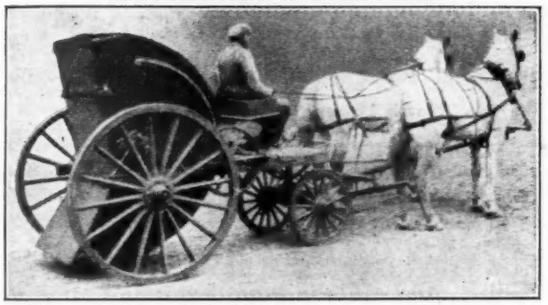

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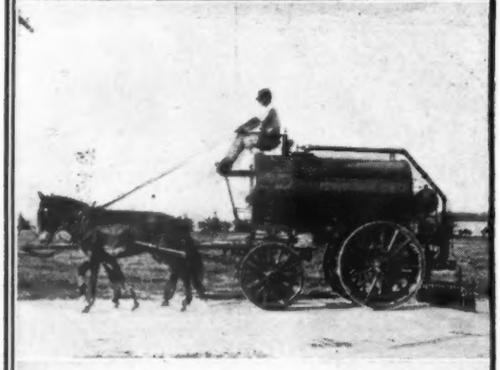

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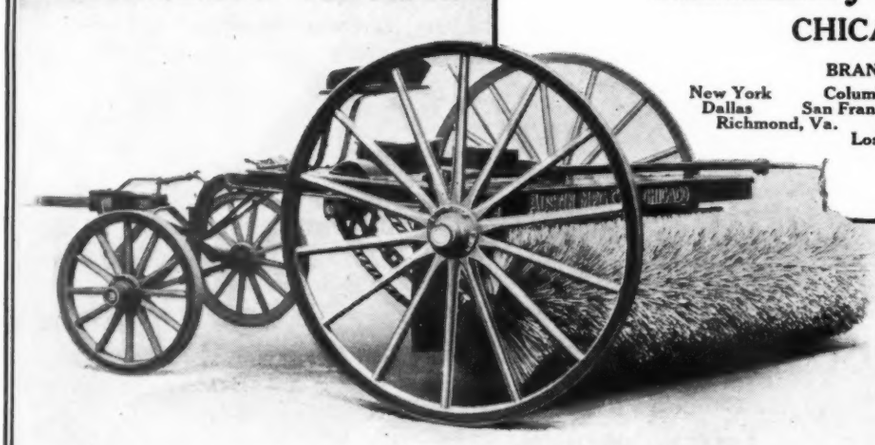
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